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EFFECTS OF AUTOCORRELATION

UPON

LANDSTAT CLASSIFICATION ACCURACY

Final Report

to the

National Aeronautics and Space Administration

Contract NAS5-26111

to

Kent State University

Kent, Ohio 44242

Richard G. Craig
Department of Geology
Principal Investigator

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R.G. Craig

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I. ABSTRACT

The effect of autocorrelation on the accuracy of a parallelopiped classifier of LANDSAT digital data is examined. The autocorrelation was assumed to decay to insignificant levels when sampled at distances of at least ten pixels. Thus the evaluation is done using spectral themes developed 1) using blocks of adjacent pixels and 2) using groups of pixels spaced at least 10 pixels apart. Effects of geometric distortions are minimized by using only pixels from the interiors of land cover sections. Two land cover classes are considered, 'agriculture' and 'residential'. The study is performed in two areas Richmond, Virginia and Denver, Colorado.

Accuracy is evaluated for three classes; agriculture, residential and "all other"; thus both type I and type II errors are evaluated by means of 'overall classification accuracy'. All classes give comparable results. Accuracy is approximately the same in both techniques. However, the variance in accuracy is significantly higher using the themes developed from autocorrelated data. In both areas it is found that the vectors of mean spectral response were nearly identical regardless of sampling method used. However the estimated variances were much larger when using autocorrelated pixels.

Evaluations were made on five 7½' quadrangles in the Denver area, using nine sections of 21 x 26 pixels each as the test sites for a total of 4914 pixels. In Richmond, two quadrangles, using 12 sections of 13 x 16 pixels each were used, giving for both quadrangles of the Richmond area, a total of 4992 pisels. Only uncorrelated (distant) pixels were used for testing and only interior pixels were considered in the entire analysis. Pixels were included in the training and testing groups in relative

proportions closely approximating their occurrence in the population.

Because evaluation of type II errors is not performed as frequently as evaluation of type I errors these results suggest that the effects of autocorrelation may be overlooked. An alternative which is available would take advantage of the tradeoff between type I and type II errors. For a given level of type II error acceptable the researcher can achieve a lower level of type I error using the dispersed sampling method.

II. INTRODUCTION

The National Aeronautics and Space Administration (NASA) is presently under contract with the Bureau of Census engaged in an applications pilot test (APT) designed to demonstrate techniques for automated mapping of urban land cover classes and to detect expansion of these areas. Because the Census Bureau is now charged with performing a census once every five years it is necessary to find efficient and cost effective means of performing that census. The goal of the APT is to develop a means to use LANDSAT imagery to regularly inventory the growth of urban areas in the United States. Such imagery is available in digital format which lends itself to a computer based classification procedure. Using such a method a very rapid and up-to-date classification of urban growth could be performed in a most cost effective fashion. If this is to be done, a relatively sophisticated digital computer based classification technique must be developed.

The most effective of such schemes which are available are based upon statistical theory. Such classification schemes utilize advanced maximum likelihood classification (ML) techniques (Swain and Davis, 1978). The ML procedure relies upon statistical summaries of the reflectance characteristics of various land cover classes developed in certain areas called training sites. From these training pixels the vector of means and the variance-covariance matrix are developed. With these developed for each land cover class of interest a discriminant function approach is used to determine whether unclassified pixels belong in one land cover class or another.

Several assumptions are made in deriving the ML equations; a very critical assumption is that the vector of means, μ , and the variance-covariance matrix, Σ , are estimated from N samples which are mutually independent and hence each sample will contribute one degree of freedom to the estimate. The estimates of the components of Σ , are incorrect when the assumption of independence fails. In the simple Markovian situation, the direction of deviation depends upon the coefficients of the process (Cliff and Ord, 1980).

Unfortunately, the LANDSAT data are neither independent nor Markovian (Craig, 1976; 1979); they display consistently -- in the terminology of Box and Jenkins (1970) -- and ARIMA (1,0,1) structure, although the co-efficients vary significantly with location (Craig and Labovitz, 1980). Thus the question arises whether the presence of the ARIMA (1,0,1) structure will significantly degrade the classification accuracy of a ML approach; and if so, what techniques can be developed to remedy this defect. This research is an attempt to answer these questions.

Two areas are chosen for study, Richmond, Virginia and Denver, Colorado. For each the degree of autocorrelation is estimated and an algorithm developed capable of filtering the data to produce independent observations. Using this a comparison will be made between results of classifications on filtered and unfiltered images. A test will be made to determine if filtered images result in an improved classification accuracy.

III. OBJECTIVES AND PROCEDURES

As a result of this project, the following objectives will have been attained. First, estimates of the structure of the ARIMA process will be created and the degree of homogenity of this structure within an image will be known. This will be achieved by means of the Box and Jenkins (1970) autocorrelation programs used in conjunction with an analysis of variance design. The sampling scheme required to produce independent observations will be developed and a method of filtering the ARIMA structure will be defined.

Using this method a land cover map will be digitized for use in accuracy evaluation of the two procedures being examined. An algorithm to select training and testing sites for development of the various classifiers being examined will be encoded so that such selection will be as objective as possible. This algorithm will make use of the digitized land cover map mentioned above. To test the results of the classification procedures using each of the two training techniques a computer program will be written to compute the alpha and beta confidence levels as well as other measures of accuracy of evaluation. From these techniques a statement of the importance of autocorrelation on classifier accuracy will be developed, so that a decision on whether filtering is necessary can be reached.

To achieve the objectives stated above the following procedures will be employed. First, two scenes will be analyzed one from Richmond and one from Denver and they will be selected and ordered and when installed the image quality will be tested. To determine the appropriate method of

filtering the data to produce independent observations, the structure of the autocorrelation will be tested by means of analysis variance procedure. The sampling procedure required for that analysis must be established. From the image tapes mentioned above scan lines will be subset and for each scan line the autocorrelation function (ACF) and partial autocorrelation functions (PACF) of the raw data and of the first and second differences will be computed. This will be done with programs available on the KSU Burroughs Computer. The first 20 values of ACF and PACF will be extracted for storage in a disk file. Summaries of the means of the ACF and PACFs will be made. For those 20 values of the ACF and PACF sampled and stored a factor analysis will be performed using the SPSS program available at KSU. Significant components will be extracted and used to perform the analysis of variance. If so indicated by the analysis of variance partitions of the structure of the autocorrelation will be employed to design specific sampling schemes as necessary for specific areas. A sampling interval will be determined and an algorithm created to allow filtering of these images to produce independent samples.

From photo interpreted data supplied by NASA a base map of land use classified according to the USGS scheme (Anderson, et al., 1976) will be produced. These data will be digitized and the data base stored on disk for use in later analysis. An algorithm will be implimented to allow choice of specific training sites consisting of blocks of adjacent pixels for use with the blocked sampling scheme. A second algorithm will be created to choose training sites of samples which are spatially independent. Samples will be chosen randomly within each of these constraints. Sample sizes is

to be equal for each of the two techniques. Using these algorithms areas will be chosen for testing the results of the two classifiers. Again sample sizes will be equal for each of the two techniques. The ORSER program STATS will be used to develop training statistics on each of these two types of training pixels. The program PPD will be used to classify the land cover areas which are to be tested. This classification will be output to disk files for storage and later used in the evaluation procedure.

A computer program will be implemented which will automatically compare the classified image with the ground truth as digitized. From this comparison estimates of type I and type II error statistics will be computed. An analysis of the error statistics will be performed to test the null-hypothesis that there is no significant difference between the results obtained using the blocked and diffuse sampling procedures. The specific alternative to be considered is that the diffuse sampled image produces results significantly improved over the blocked sampling procedure. Confidence limits for this test is to be 75%. Probabilities of exceedence will be reported.

These methods mentioned above are designed to minimize the effects of errors and personnel bias in evaluating the influence of autocorrelation. These steps will detect any inhomogeneity in the structure of the autocorrelation so that the generality of the results will be assured. They are designed to produce independent observations required to test the basic question by comparison to the original autocorrelated data. They assure a rigorous unbiased test of the two approaches. The design is intended to

detect significant effects due to the autocorrelation structure, due to differences in regions and due to subtle interactions of type I and type II variations.

IV. RESULTS

A. Phase I. Richmond and Denver

1. Regions Chosen and Images Used

For phase I of this analysis two sites were chosen to be studied. The first is Richmond, Virginia and the second is Denver, Colorado. These sites were chosen as appropriate for the purpose of evaluation for the census APT. They are both areas of rapid population growth that can be expected to be recognized through expansion of the boundaries of the city itself. They are at present surrounded by areas of very low density population, mostly farm lands and/or range lands. Thus growth of these cities can be expected to be identified as a modification of the land cover classes from a low density agricultural or range land type to that of a residential, low or high density, type. Both of these sites are also appropriate in that growth in these areas has been occurring for the past decade and therefore it can be anticipated that growth will be reflected in LANDSAT imagery which is available. Because of the relatively low cloud cover in both areas a great number of LANDSAT images are available for both of these. It is also the case that aerial photography coverage is available in relative abundance for both the sites. The two sites were chosen to represent distinct terrains in the United States since terrain has been demonstrated to be an important influence upon the autocorrelation of LANDSAT data. Furthermore both of these sites have already been chosen as members of a group of regions studied in the overall census APT at NASA. The images chosen for this study are: for Richmond (figure 1) an image of November 3, 1978, image number 30243-15093, for Denver (figure 2) an image of September 28, 1978 with image number 30209-17032. Because of the experimental nature of this investigation it

Figure 1. LANDSAT image of November 3, 1978, image number 30243-15093 used for the accuracy analysis of the Richmond area.

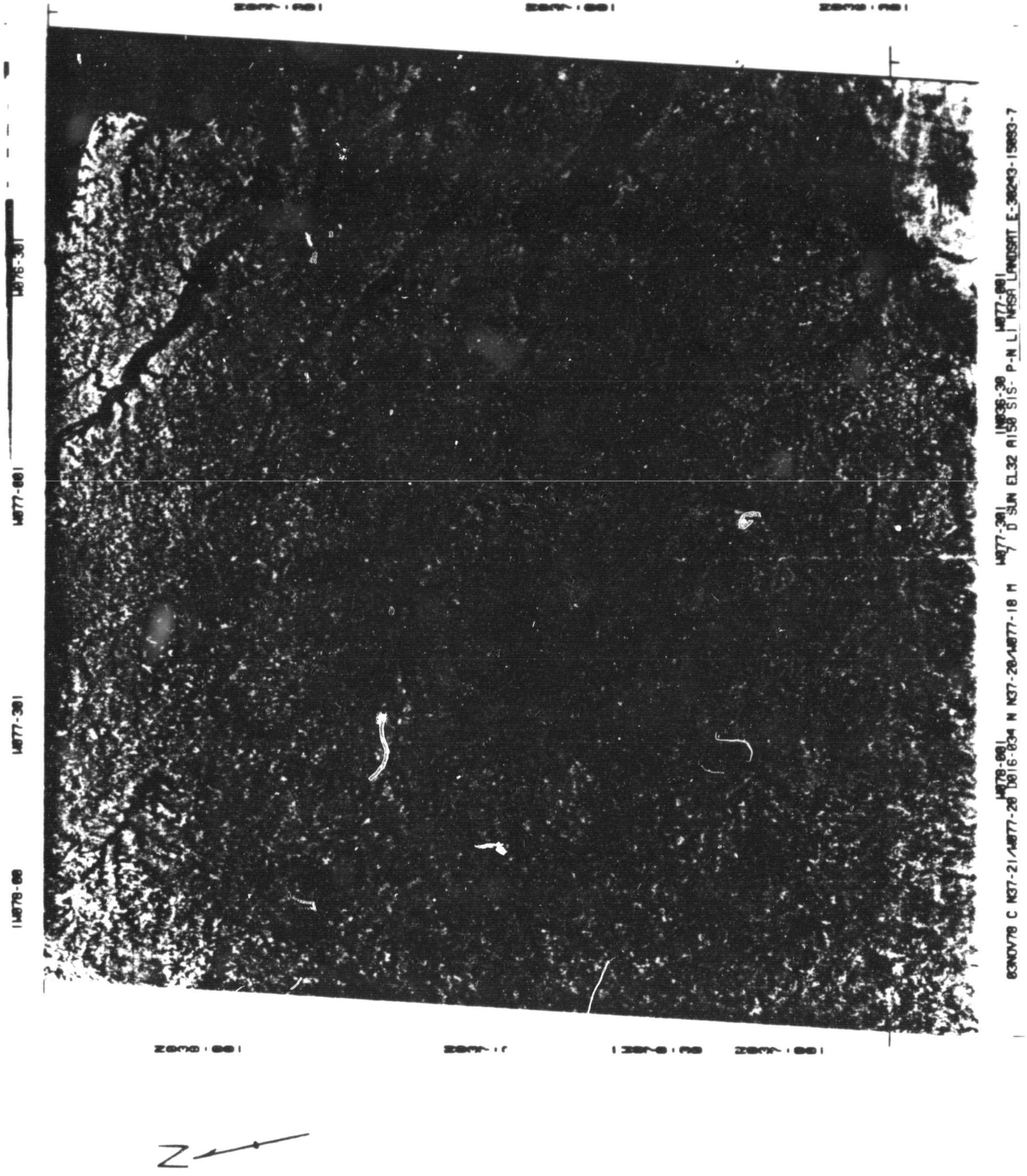
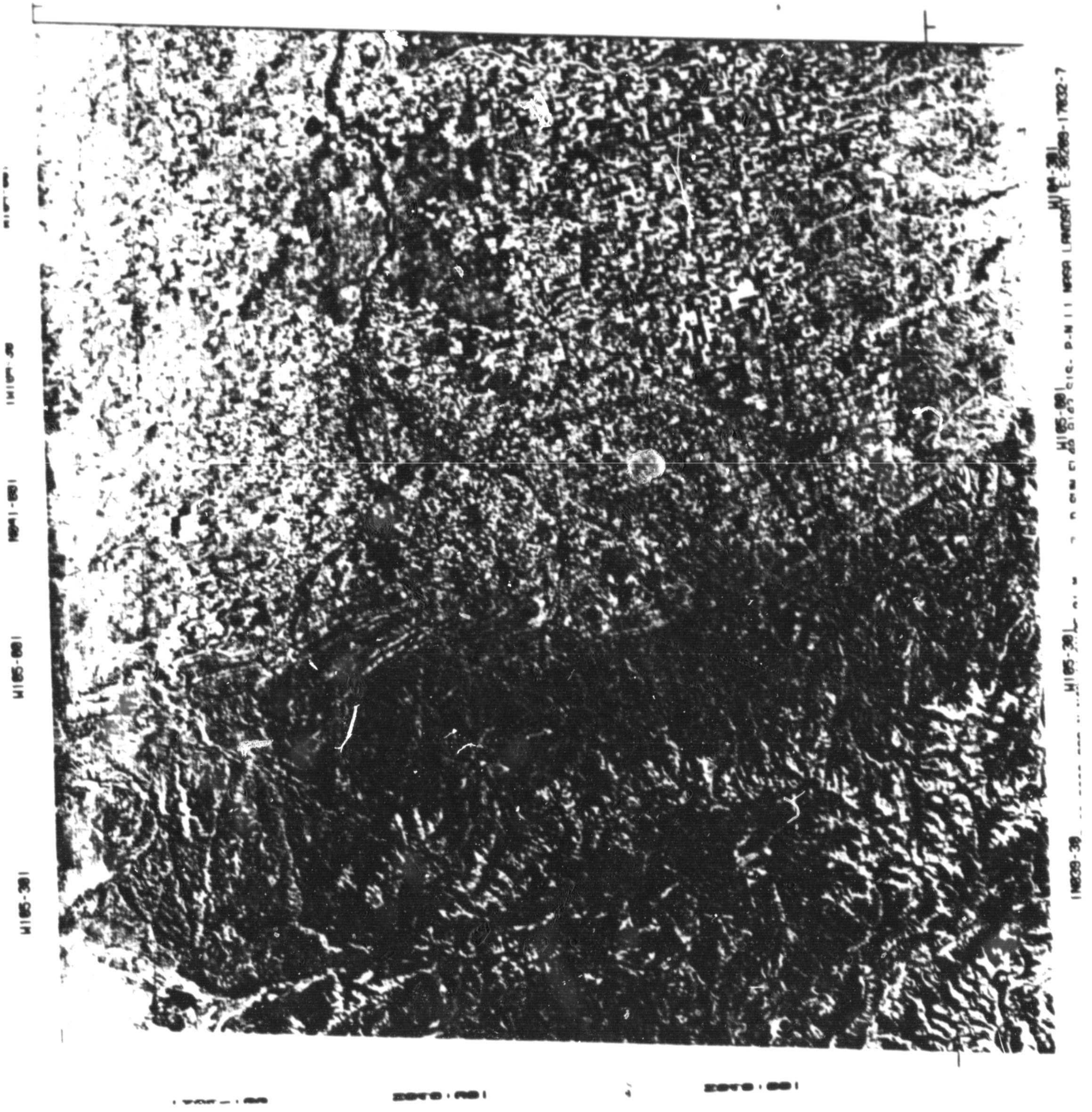


Figure 2. LANDSAT image of September 28, 1978, image number 30209-17032 used for the accuracy analysis of the Denver area.



was assumed that a single image from each site would be sufficient to test the effects of autocorrelation and document the extent to which it exists. These images were chosen because they demonstrated the image quality of nine, highest available, and both had cloud cover of 0%, the least amount, of course. Previously cloud cover had been shown to be an important influence on the degree of autocorrelation (Craig and Labovitz, 1980). It was desirable in this case to keep that influence to a minimum so that the autocorrelation could be assumed to be essentially constant from region to region. Both of these represent very recent images taken from the LANDSAT 3 satellite. The dates are such that they closely correspond to the dates for which aerial photographs were obtained for each site and therefore can be expected to closely correspond to the ground truth data derived from those aerial photographs. Photo identification numbers for those aerials photographs are for Denver 148-93 and 148-94 taken October 15, 1978.

Within each image particular areas were chosen for emphasis in the study. In the Richmond area two distinct 7½' quadrangle areas were chosen. These are the Seven Pines quadrangle and the Chesterfield quadrangle. For the Denver area the Fitzsimmons quadrangle was used. These quadrangles were chosen because they are near their respective cities and at points where the city has been growing and has demonstrated growth during the time at which the images were taken. They also have the advantage that water is present in sufficient quantities in each of these quadrangles to facilitate the location of the respective sample sites and to insure the geometric correction of the imagery was done properly. The standard USGS 7½' quadrangles were used to define the sample sites because they are available for each of t ,

and, with the overlay of forest cover, urban areas and water class available, facilitate the location of points in each site.

Within each quadrangle a grid is used to define the exact sites at which samples would be taken for the accuracy evaluation. A grid was used to define the sample sites in order to ensure that they would be selected randomly, that is independent of any preconceived notions of land cover class importance, degree of autocorrelation or accuracy of classification. Grids were defined to be large enough so that a number of samples might be obtained for each evaluation technique from each grid chosen. They were large enough so that samples could be collected in an efficient manner but so that wasteful collection of samples could be avoided. The grids were laid out on a square net in such a way to ensure that all land cover classes would have an equal probability of selection within the sample set. This was important in order to avoid bias in the evaluation of the accuracy of classification techniques. Each grid was large enough to ensure that enough pixels could be obtained for both evaluation techniques, BLOCKED and DIFFUSE. They also had to be large enough so that samples could be taken without needing to include border line pixels which could confuse the accuracy evaluation procedure. The location of the quadrangles relevant to the two areas, Richmond and Denver, are shown in figure 3. The locations of the specific grids chosen within each quadrangle are outlined in figure 4.

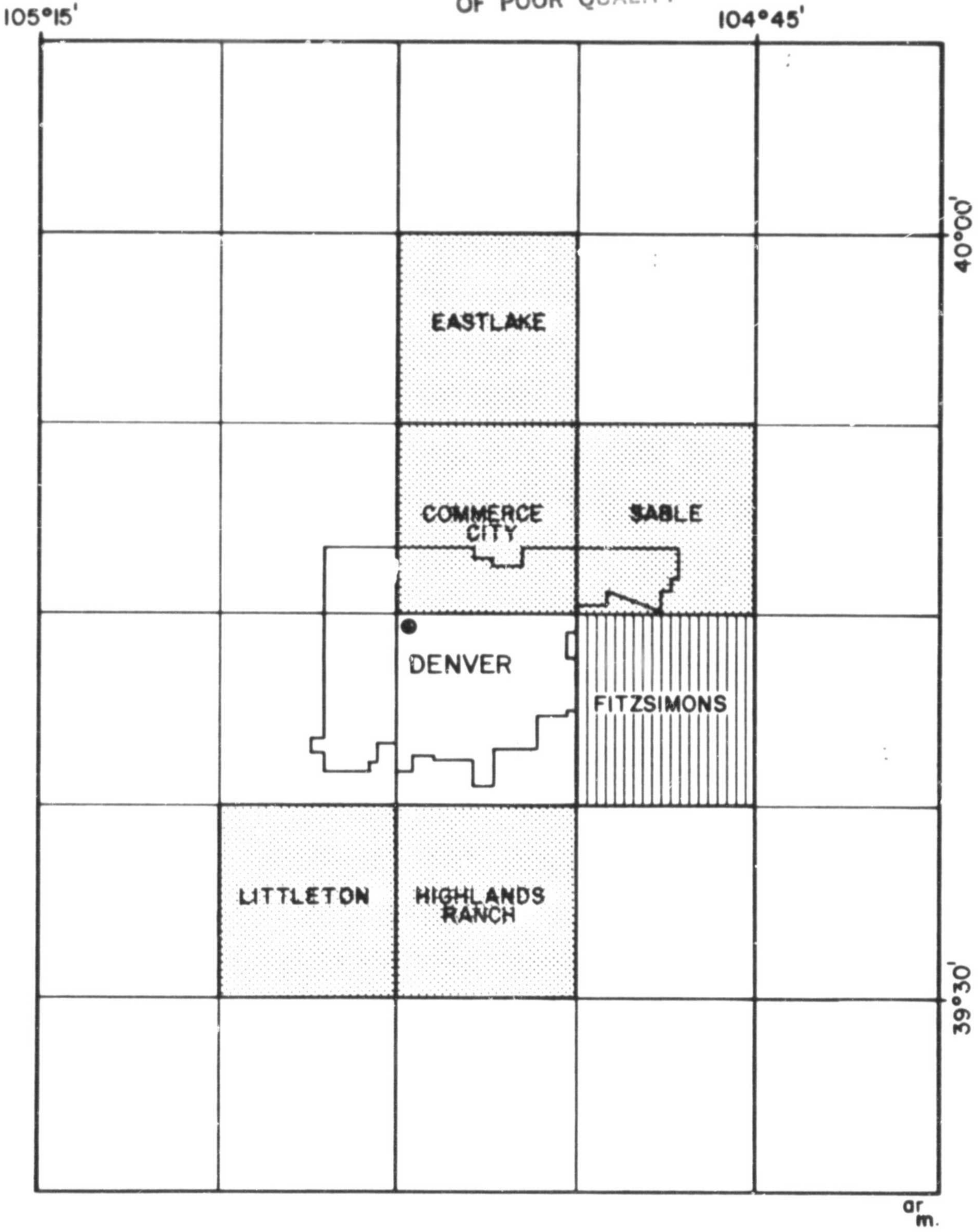


Figure 3a. Locations of quadrangles chosen for the phase I analysis relative to Denver. Note, the phase II quadrangles are also shown.

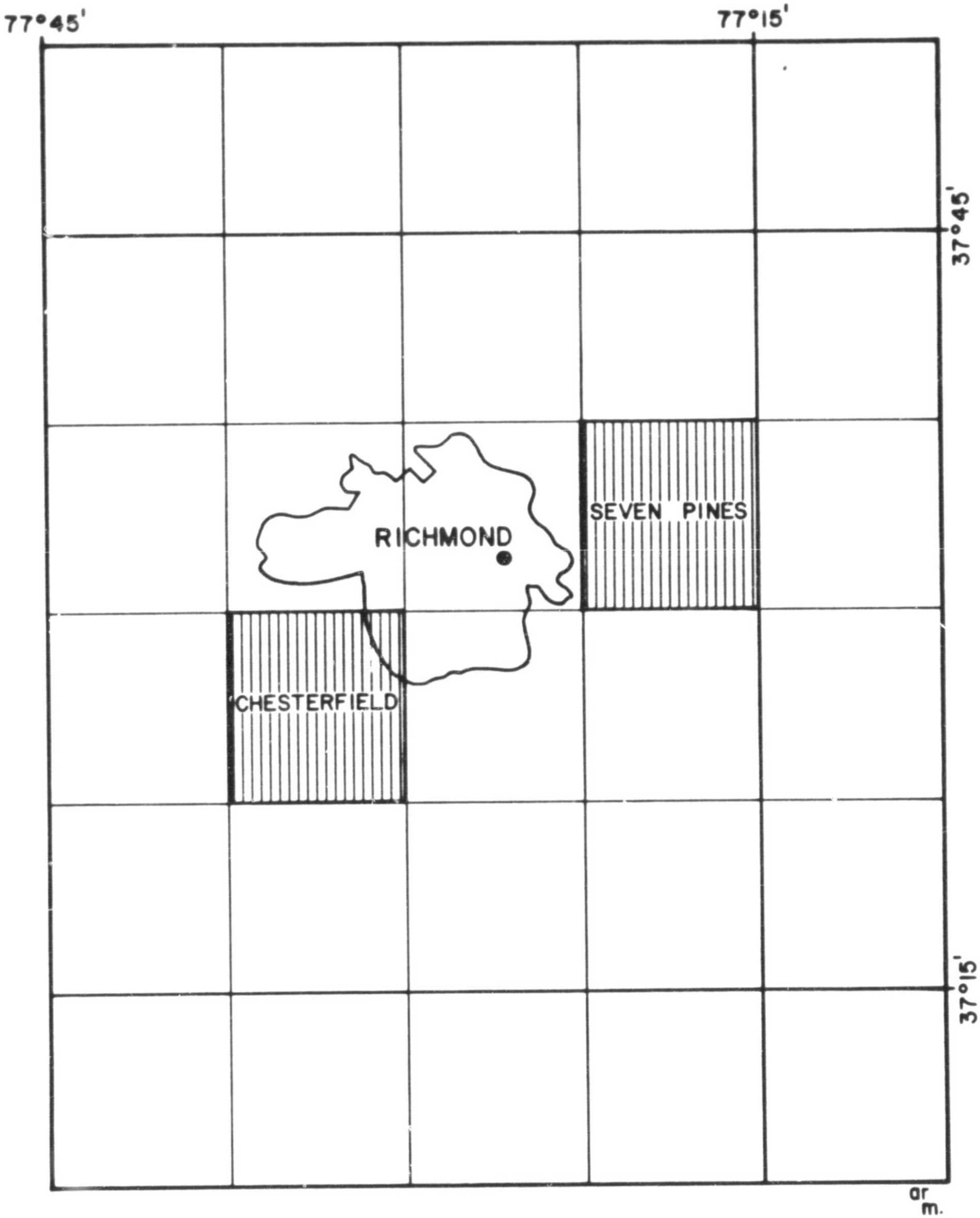
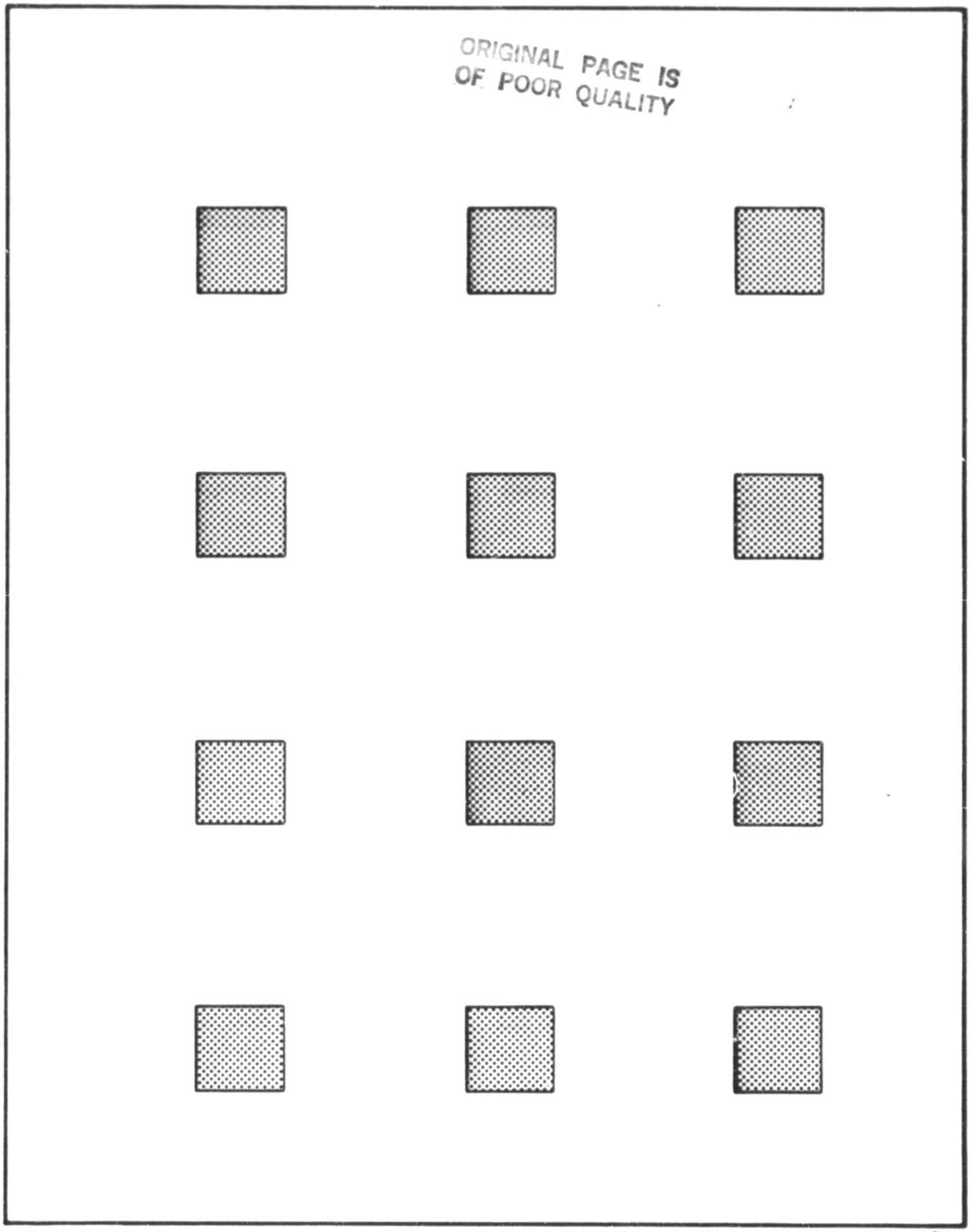


Figure 3b. Locations of quadrangles chosen for the phase I analysis relative to Richmond.

Figure 4. Locations of grids within the quadrangle studied. Photo-interpreted data were provided for each of these grids. (a) Chesterfield, Virginia, (b) Seven Pines, Virginia, (c) Fitzsimmons, Colorado.



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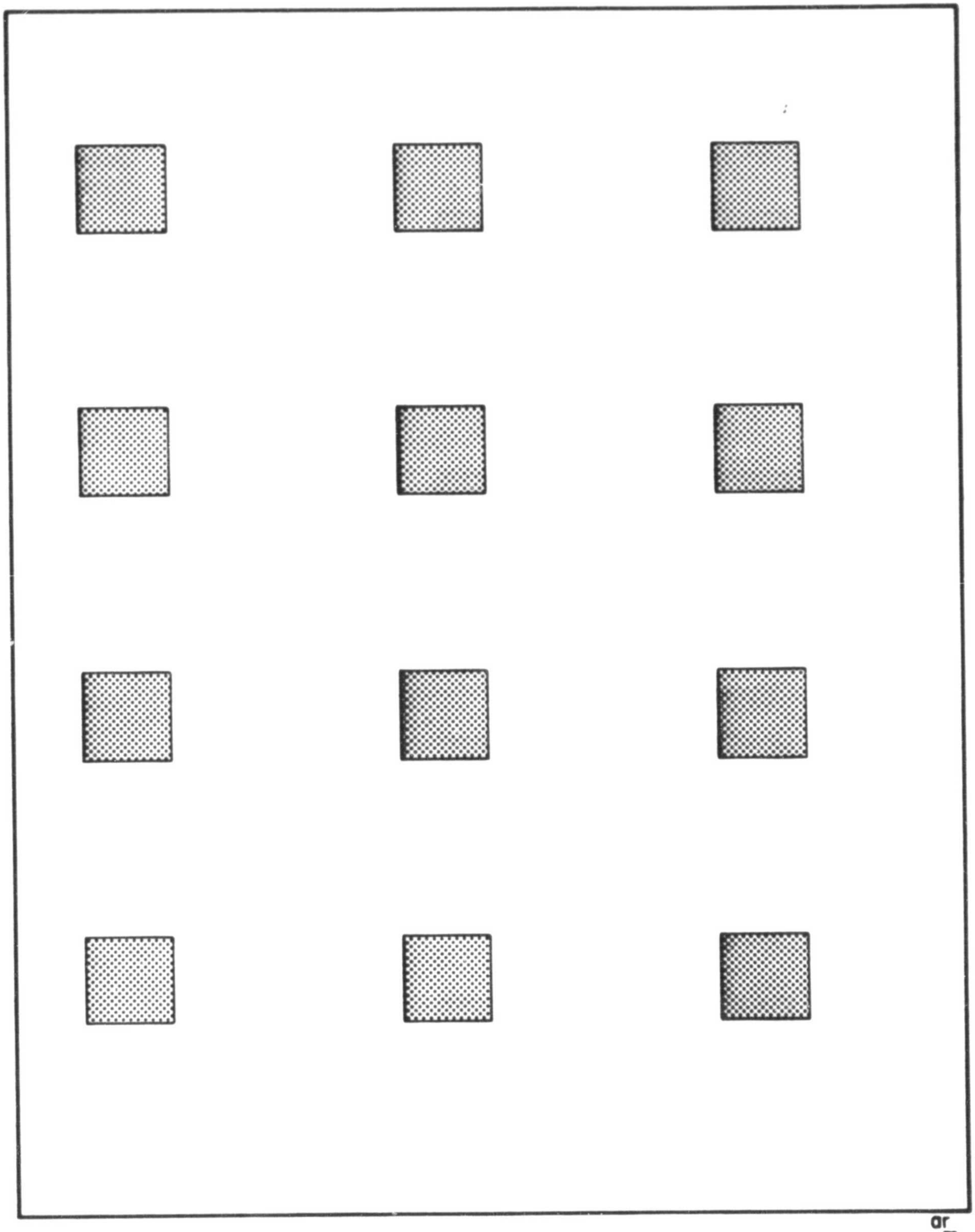

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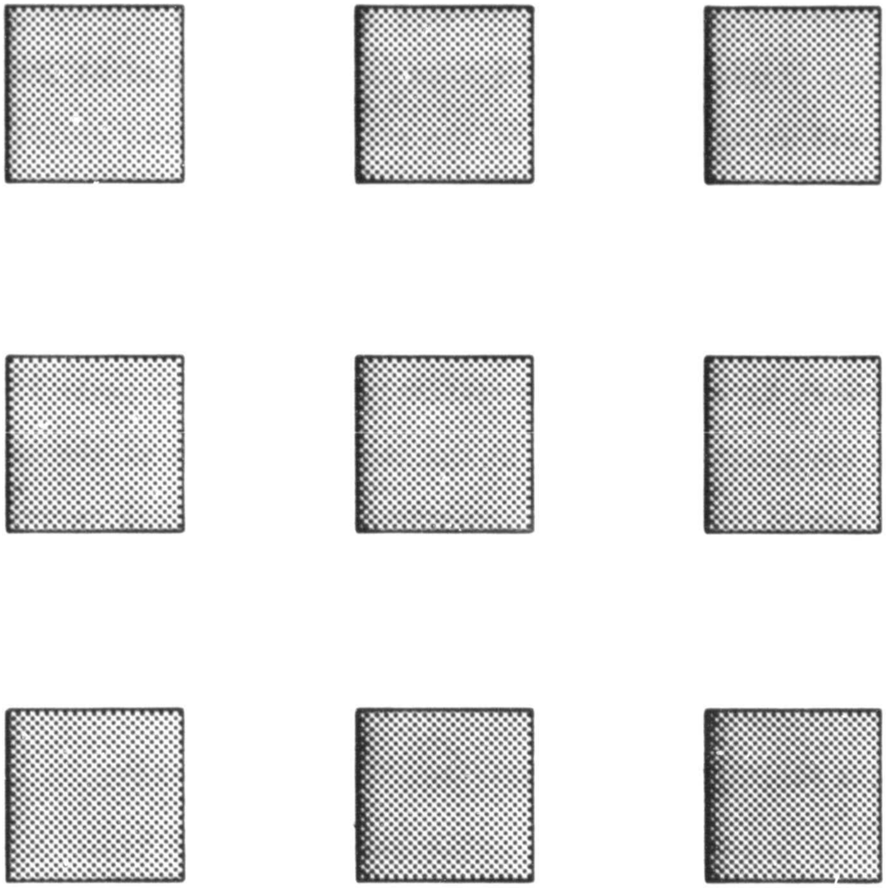

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2. Preliminary Checks

To ensure that there are no blatant errors in the computer compatible tapes obtained for each of these images a preliminary test of the quality of the imagery was performed. This test consisted of subsetting a number of scan lines from each image and subjecting them to basic statistical analyses. Eight scan lines were subset from each of the two images. Their coordinates are shown in table 1. For each of these scan lines a plot of the gray scale level data for each of the four channels was constructed. An example of such a plot is shown in figure 5. Also computed for each of these were histograms (see figure 6) and the basic statistics as shown in table 2. These were examined for any great variations in the characteristics of the scan lines. Also done was a simple linear regression of these values versus element number within the scan lines. Results of one of these regressions are also shown in table 2. No errors were detected in any of the scan lines using these procedures and it was assumed that no errors in the imagery were present which would definitely effect results of this examination.

Because it was necessary to subset individual scan lines in order to perform the analysis of variance -- to be described next -- the preliminary test of scan lines had the advantage that it allowed us to determine that our modifications of the ORSER program SUBSET had been done correctly. These modifications allowed us to subset an individual scan line and output it to a disk file on the Burroughs system at KSU. These were then used as input to the various standard statistical programs for the analyses reported.

TABLE 1. Scan lines examined in preliminary error check.

	Track	Scan Line	Scan Line
Denver	1	1023	2302
	2	1392	0400
	3	1863	0650
	4	0159	2260
Richmond	1	1314	1403
	2	2243	0262
	3	1769	1205
	4	0566	0289

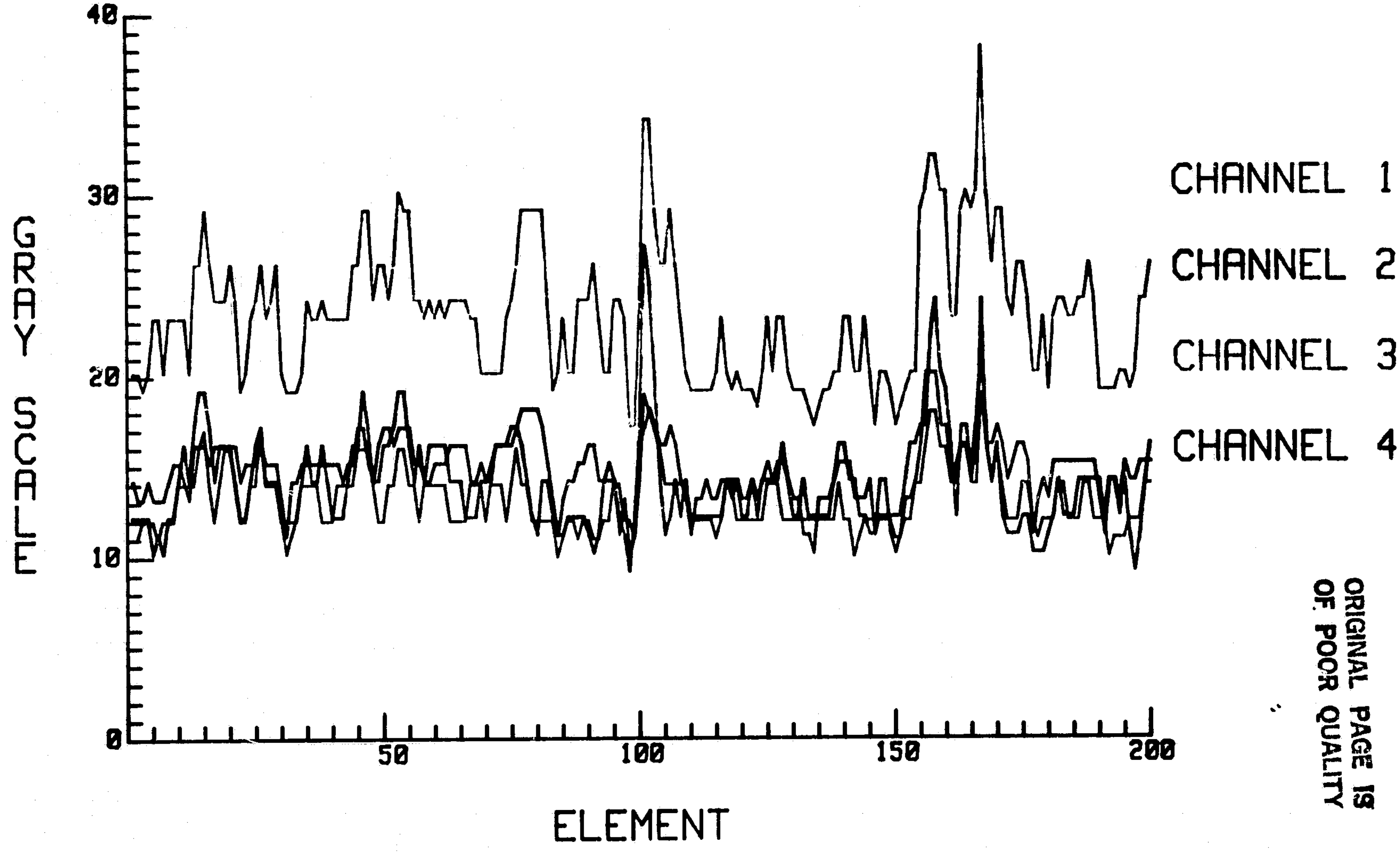

Figure 5. Example of plots of certain scan lines from each of the two images used to check image quality.

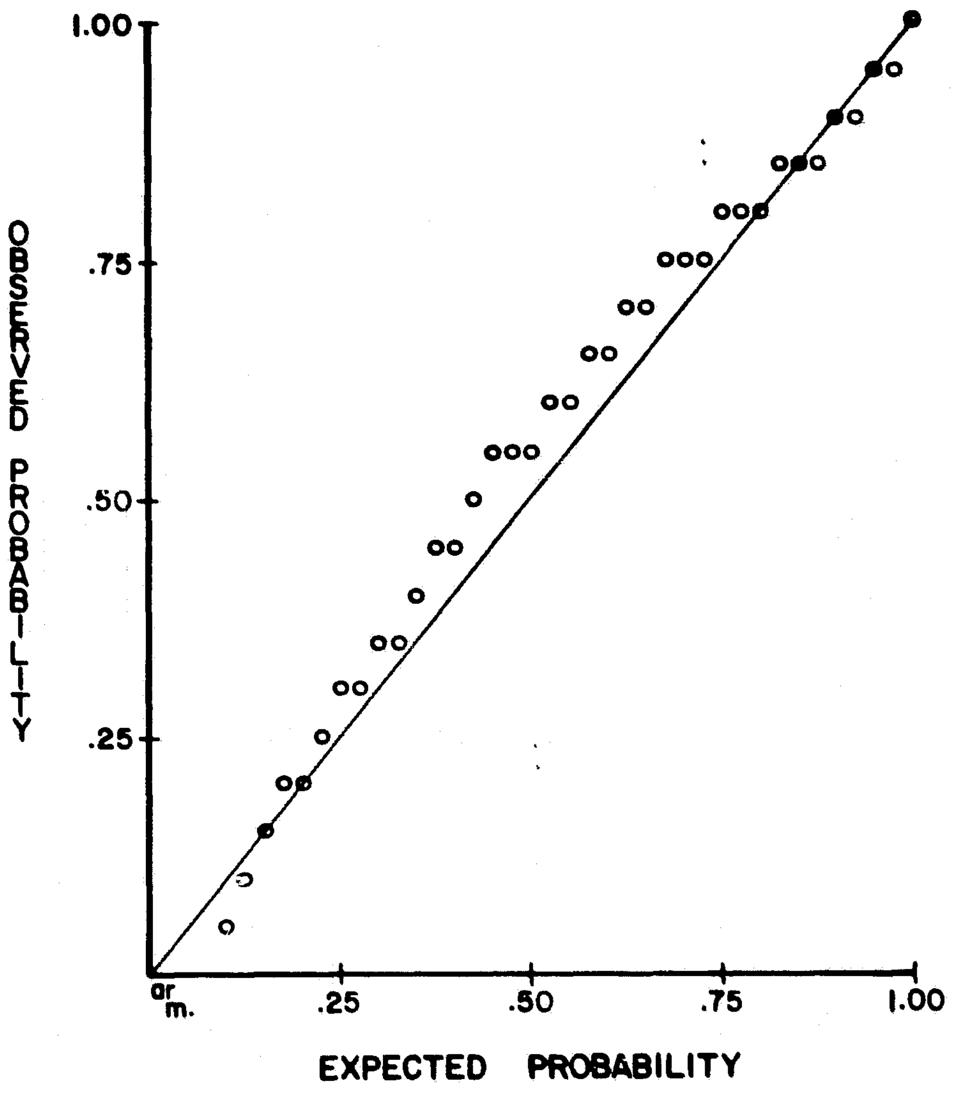

Figure 6. Example of histograms of certain scan lines from each of the two images used as a check of image quality.

TABLE 2. An example of the statistics obtained for 16 scan lines for the test of image quality

mean	13.37
standard deviation	2.17
mode	12.00
median	12.36
skewness	1.25
kurtosis	1.44
standard error	0.08
variance	4.70
minimum	10.00
maximum	25.00
range	15.00
sum	10589.00
N	792

Results of Regression of Gray Scale Level (Dependent) Versus Sequence Number

$R^2 = 0.056$

$F = 46.63$

St. Er. $\hat{\beta}_1 = 0.00033$

Lower 95% limit on $\hat{\beta}_1 = 0.00159$

Adjusted $R^2 = 0.055$

Sign F = 0.00000

Upper 95% limit on $\hat{\beta}_1 = 0.00288$

Standard error = 2.109

$\hat{\beta}_1 = 0.00224$

3. Test of Autocorrelation Structure

The underlying objective of this research is to determine the effects of the presence of autocorrelation on classification accuracy. To do this it is necessary to compare the results of classifiers when the autocorrelation structure is present and when it is absent. Therefore it will be necessary to be able to remove the autocorrelation structure from the image so that the image with it removed can be compared to the image with it present. Thus it will be necessary to define specifically the exact characteristics of the autocorrelation structure. This is only possible if we can be confident that that autocorrelation structure is itself constant within any given area. Previous work by Craig and Labovitz (1980) has shown that there are significant sources of variation in the autocorrelations structure. For instance, it has been shown that the autocorrelation structure varies significantly from one location to another in the United States. In particular that structure is significantly different between Denver and Richmond. This has been interpreted to mean that there is some location effect on autocorrelation. The nature of this location effect is not definite. Some possible sources of the variability of autocorrelation structure have been defined and tested by Craig and Labovitz (1980) and by Craig (1981). At present it is believed that the location effect is in fact an effect due to differences of terrain from one area to another (Craig, 1981; 1982). It is therefore desirable to show that within the areas of interest in this study the autocorrelation structure does not vary significantly. We will test for the presence of this autocorrelation structure and for variability within the images by means of an analysis of variance design.

The design is set up to check for variations within the image as a function of location and as a function of the particular channel being sensed. The location is studied as two separate factors. The first is 'tracks' which are defined as a four-part partition of the image vertically. The second major factor of location is 'area' which is defined as a five-part partition within the various tracks. All four channels are examined in this study. For each combination of track, area and channel within a given site, Richmond and Denver, two replicates were chosen. Therefore with five areas within each of four tracks and each having four channels and two replicates a total of 160 scan lines had to be examined for each image making a total of 320 for both sites.

The procedures used in this analysis was first to subset the 320 scan lines needed. The scan lines were chosen within each of these pre-defined regions at random to fall within plus or minus 100 scan lines of a center scan line. The locations of the scan lines chosen are shown in figure 7. The randomness of this selection procedure was tested by examining the autocorrelation function of the selection values. No departures from randomness could be demonstrated. The exact coordinates of the scan lines used are reported in table 3. From each of these scan lines the standard programs of Box and Jenkins (1970) were used to calculate the autocorrelation function and the partial autocorrelation function to lag 10. Each of these values was output to a disk file for further analysis. This was done by means of minor modifications of the Box and Jenkins programs at Kent State University. Improvements were also made in the plotting routines. Summary plots of the mean ACF and PACF values are shown in figure 8. The data themselves are presented in Appendix B.

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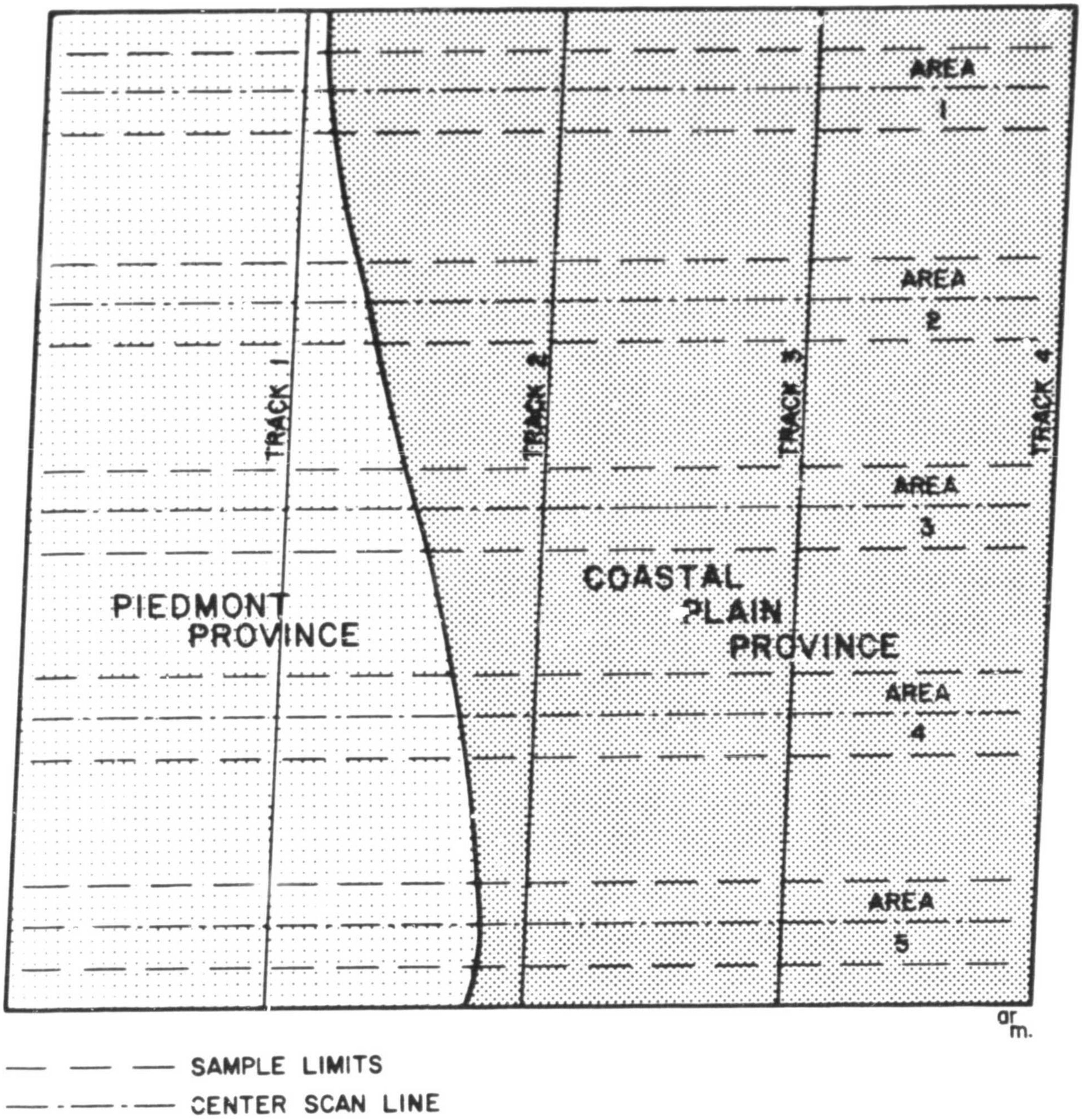

Figure 7a. Locations of scan lines chosen for the analysis of variance for the Richmond area. Physiographic regions of the area are shown for reference.

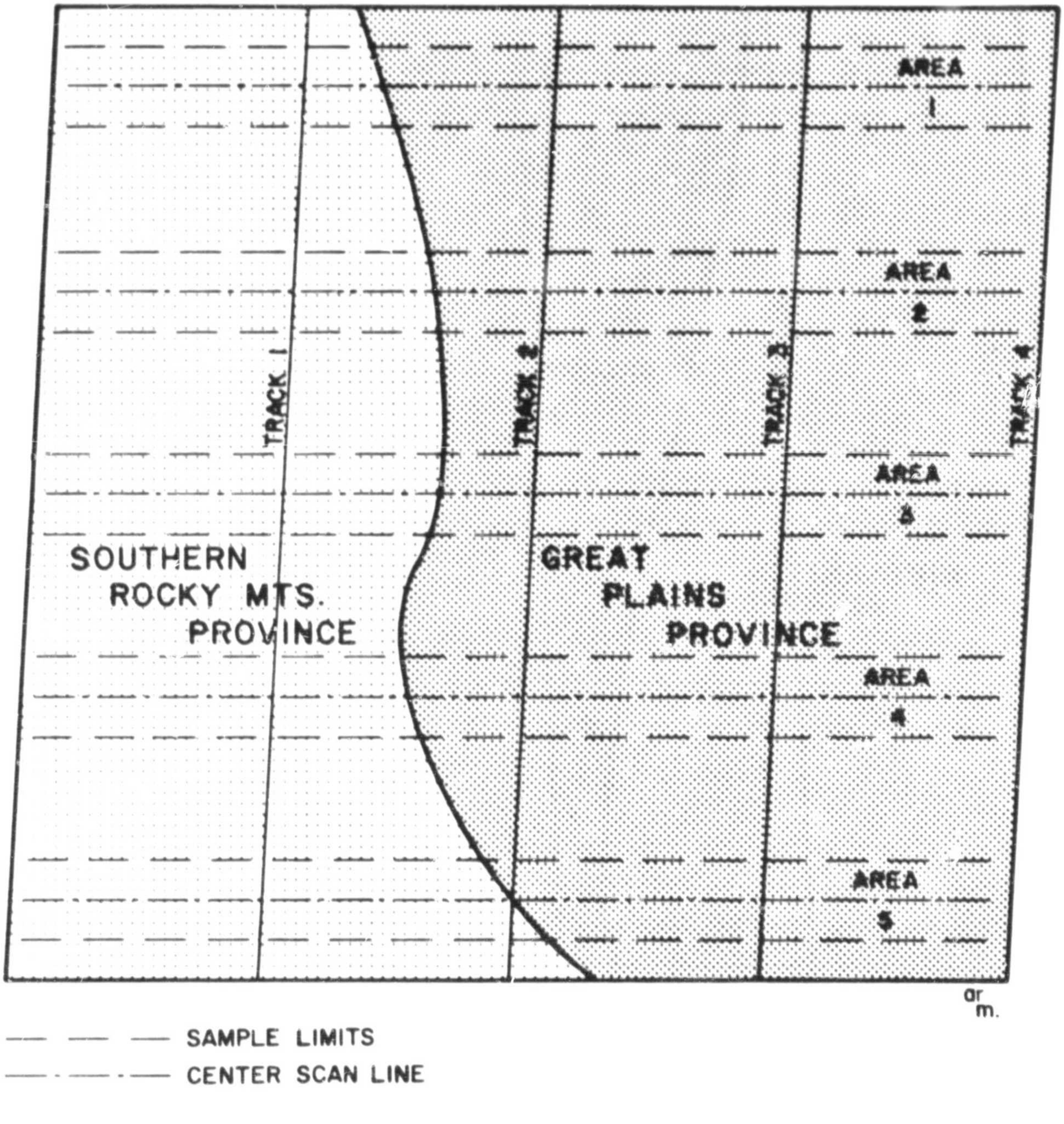

Figure 7b. Locations of scan lines chosen for the analysis of variance for the Denver area. Physiographic regions of the area are shown for reference.

Table 3. Scan lines subset for ANOVA design.

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	BASE SCAN LINES									
	200		700		1200		1700		2200	
	REPLICATE		REPLICATE		REPLICATE		REPLICATE		REPLICATE	
TRACK	1	2	1	2	1	2	1	2	1	2
	DENVER									
1	188	146	729	735	1134	1127	1681	1734	2183	2134
	138	139	682	648	1111	1208	1632	1778	2132	2268
	182	216	650	677	1113	1271	1764	1601	2257	2168
	191	250	699	626	1282	1184	1782	1708	2269	2103
2	172	125	611	653	1224	1221	1750	1749	2202	2219
	109	113	757	617	1110	1232	1760	1628	2117	2210
	138	235	691	665	1112	1117	1743	1645	2250	2107
	117	277	740	615	1200	1256	1718	1718	2139	2274
3	157	136	627	635	1110	1259	1689	1705	2257	2268
	124	185	603	793	1224	1214	1760	1702	2227	2290
	240	165	643	776	1200	1166	1753	1718	2168	2144
	241	109	719	717	1238	1109	1770	1639	2289	2144
4	105	172	605	783	1276	1288	1717	1655	2240	2142
	280	107	685	743	1278	1228	1606	1621	2295	2169
	172	163	764	772	1201	1209	1793	1794	2298	2135
	262	151	624	637	1275	1243	1628	1733	2128	2233
	RICHMOND									
1	269	239	715	736	1253	1136	1639	1752	2105	2167
	263	142	723	615	1235	1257	1759	1787	2171	2273
	291	114	790	663	1200	1235	1672	1727	2276	2125
	224	268	633	703	1235	1114	1645	1690	2214	2254
2	289	206	627	714	1214	1235	1682	1731	2247	2113
	207	197	684	754	1257	1150	1746	1785	2182	2162
	291	261	663	645	1140	1217	1663	1716	2203	2116
	232	114	651	716	1224	1245	1643	1761	2210	2119
3	268	107	719	722	1253	1256	1635	1602	2248	2216
	273	278	797	654	1266	1104	1778	1704	2271	2290
	114	209	650	780	1237	1217	1681	1721	2112	2157
	179	100	730	612	1139	1152	1718	1660	2156	2221
4	123	233	617	750	1175	1246	1702	1733	2161	2293
	105	205	708	660	1122	1157	1697	1740	2248	2192
	133	226	684	794	1195	1258	1738	1779	2146	2161
	195	111	669	681	1220	1137	1669	1729	2260	2157

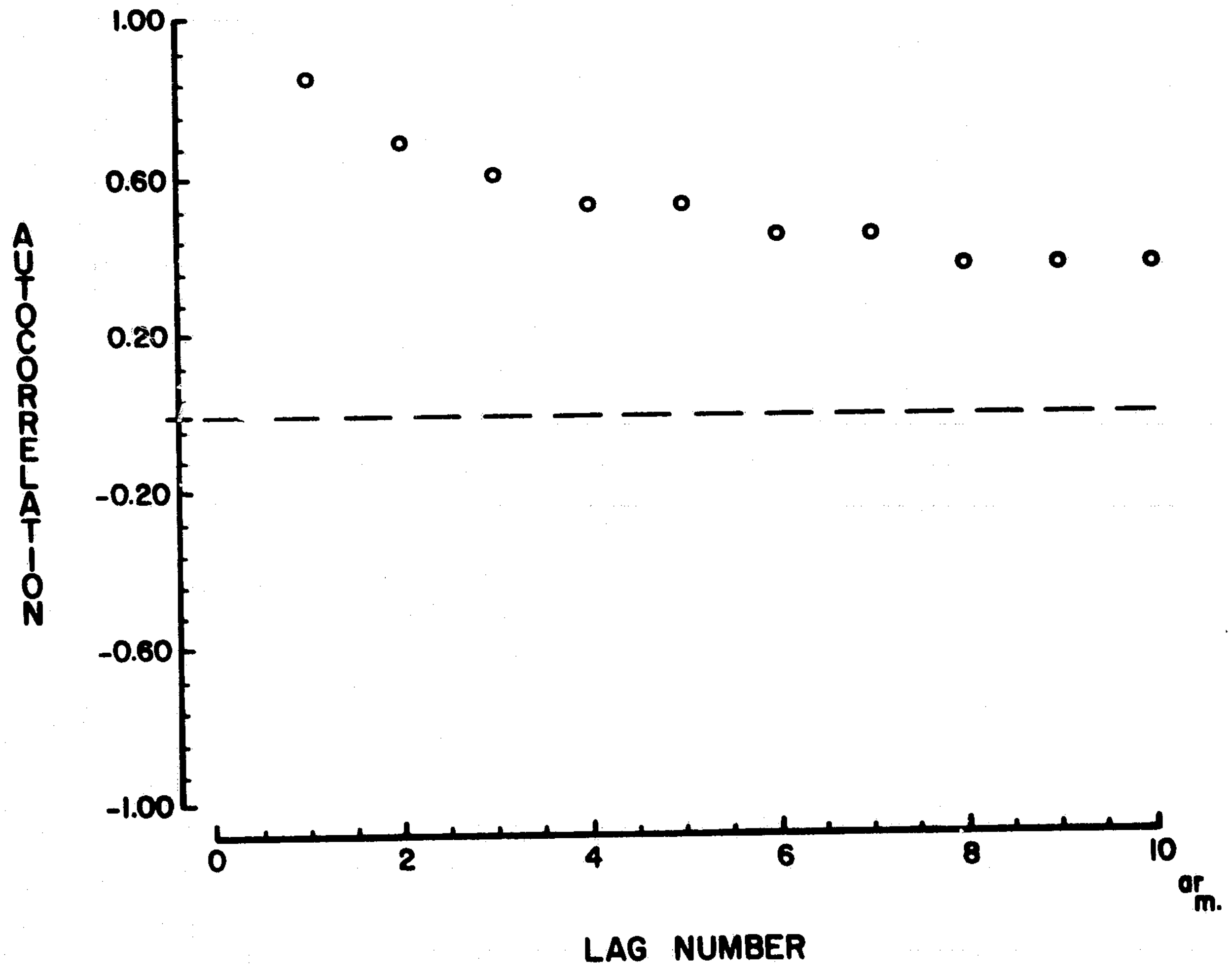

Figure 8. Mean autocorrelation function (a) of the 320 scan lines subset for the analysis of variance.

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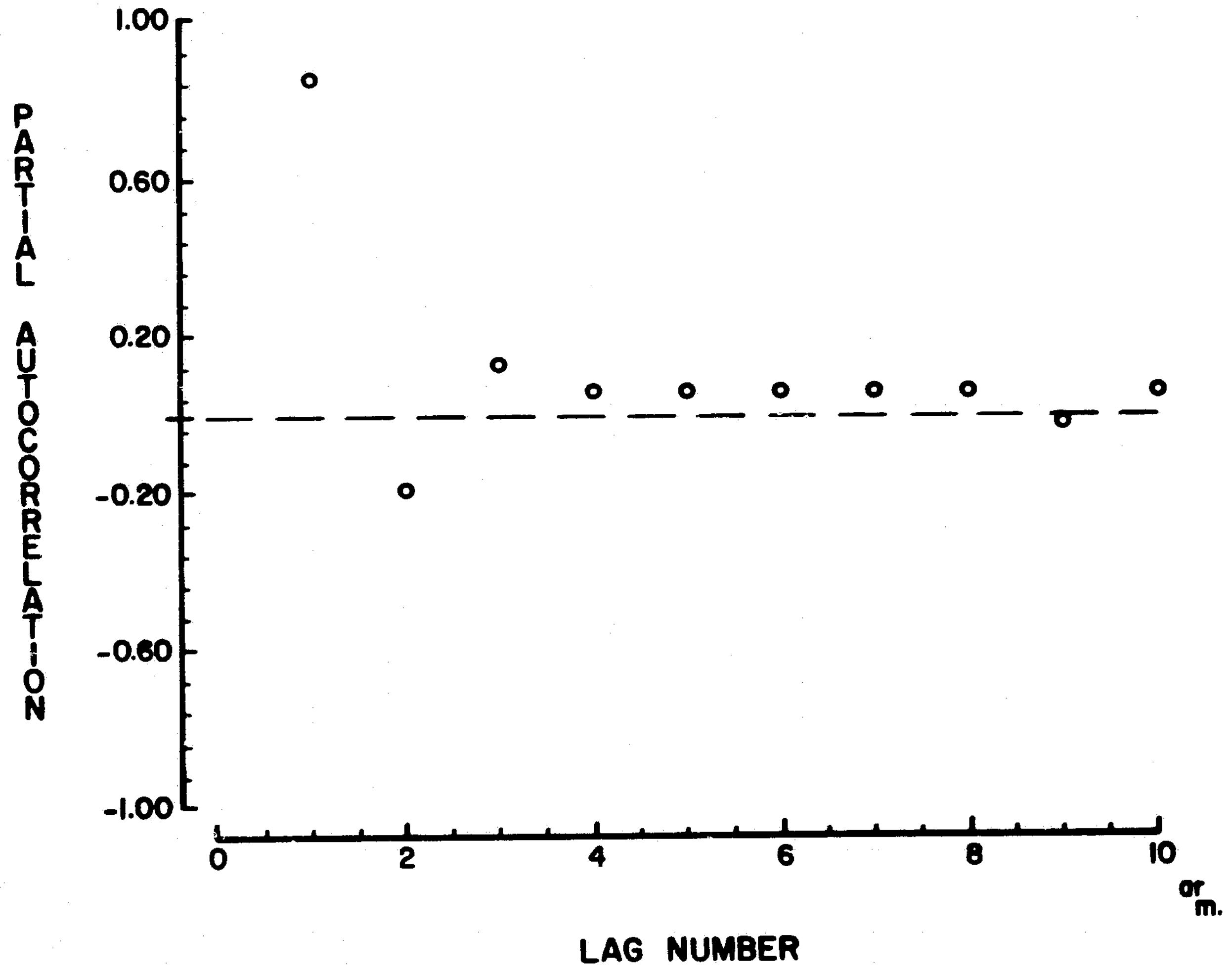

Figure 8. Mean partial autocorrelation function (b) of the 320 scan lines subset for the analysis of variance.

For ACF(1-10) amd PACF(2-10) principal components were computed using the straight method, PA(1), of the SPSS routine FANAL. The value for PACF(1) is the same as ACF(1) so it was not repeated in order to avoid a singular matrix during factor computation. Figure 9 shows a plot of cumulative variance explained by each eigenvalue. From figure 9 it can be seen that the three largest eigenvalues explain 70% of the variance of the data. The first eigenvalue is clearly significant. Factor loadings are reproduced in table 4 for the first three eigenvalues. These values mirror the pattern reported by Craig and Labovitz (1980). Component one characterizes the ACF terms, the PACF terms split over the remaining components. Using the factor score coefficients, table 5, component scores were computed for each of the 320 observed ACF and PACF sets using the three largest eigen-vectors. These were then stored in a disk file.

It was determined that only three factors would be examined in the following analysis of variance to study the effect of location. That analysis of variance was done using another SPSS package at Kent State University. The results of that analysis of variance on the principal components as computed from the factor scores reported in table 5 above is reported in table 6. These factors were examined at a distributed 5% significance level in light of the fact that a total of 21 -- assumed to be independent -- tests were actually made. As can be seen, the majority of the possible sources of variation were not found to be significant. Factor 1 shows four different sources of variability influencing its behavior significantly. Factor 2 does show a single source of variation similar to one of those shown for factor 1. Factor 3 shows no significant sources of variation as was the case in an earlier study done by Craig and Labovitz (1980). No channel

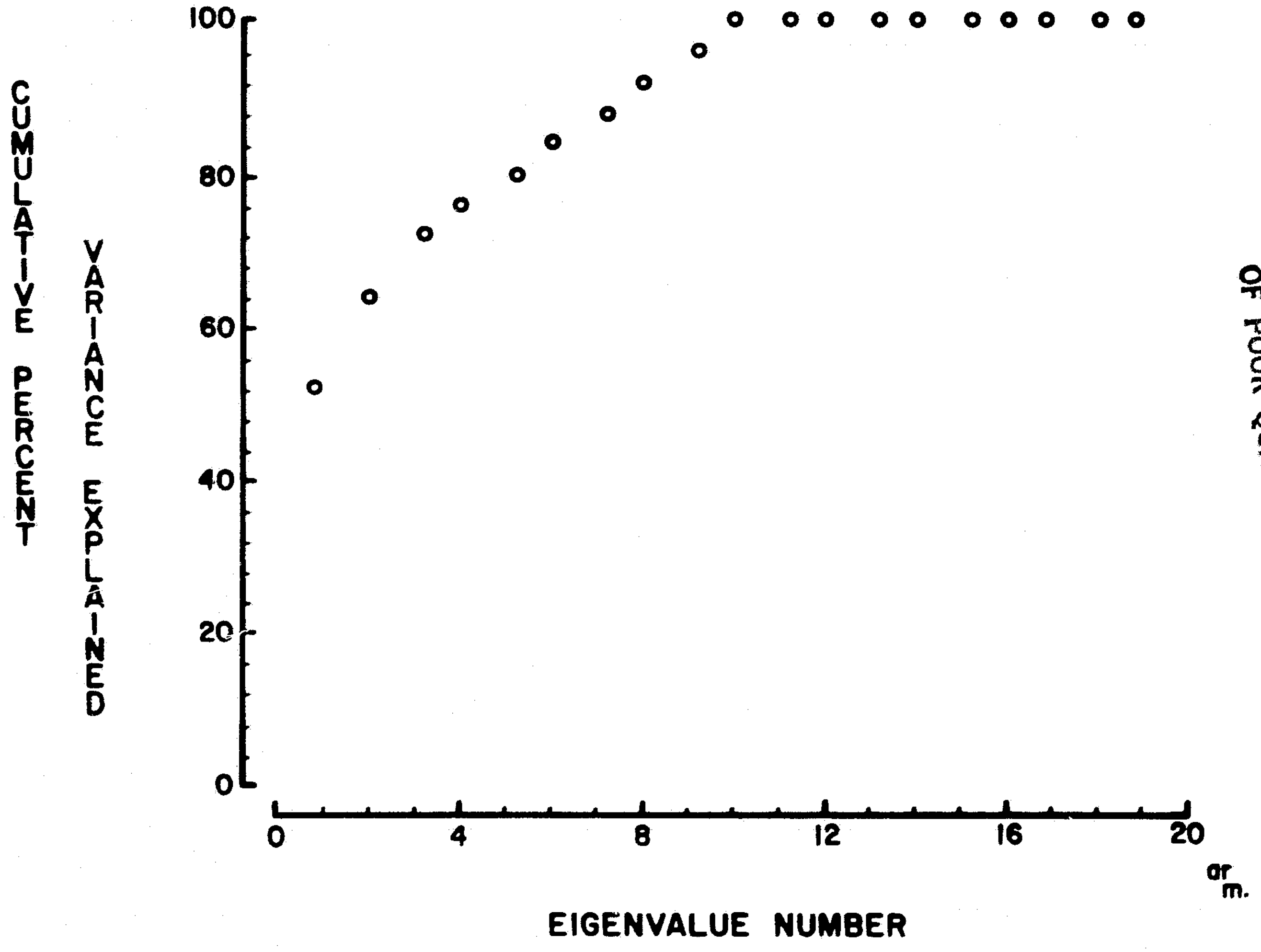

Figure 9. Cumulative variance explained by the factors computed for the ACF and PACF of the 320 scan lines prior to analysis of variance.

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Table 4. Factor loadings and communalities for the first three factors computed for the ACF and PACF's of 320 scan lines.

ACF AND PACF FACTOR MATRIX USING PRINCIPAL FACTOR

Variable	Factor 1	Factor 2	Factor 3	Communality
ACF1	0.84214	-0.41615	-0.23950	0.93973
ACF2	0.91631	-0.28091	-0.16819	0.94682
ACF3	0.95732	-0.18747	-0.11181	0.96410
ACF4	0.97785	-0.11041	-0.08480	0.97558
ACF5	0.98739	-0.06446	-0.02203	0.97957
ACF6	0.99086	-0.02549	0.02835	0.98326
ACF7	0.99234	0.02357	0.05280	0.98809
ACF8	0.99017	0.08150	0.05658	0.99028
ACF9	0.98680	0.09279	0.08653	0.98986
ACF10	0.97965	0.10837	0.10522	0.98254
PACF2	0.20099	0.62445	0.35006	0.55258
PACF3	0.45816	-0.14850	-0.02190	0.23244
PACF4	0.41278	0.56053	-0.02841	0.48539
PACF5	0.26935	-0.09238	0.73928	0.62761
PACF6	0.33901	0.34449	0.04046	0.23523
PACF7	0.36541	0.36713	-0.07588	0.27407
PACF8	0.25526	0.50739	-0.10050	0.33270
PACF9	0.18827	-0.26647	0.67266	0.55893
PACF10	0.28980	0.30404	-0.31801	0.27755

TABLE 5. Matrix of factor score coefficients for the same three factors listed in Table 4.

FACTOR SCORE COEFFICIENTS

Variable	Factor 1	Factor 2	Factor 3
ACF1	0.18559	-0.20749	-0.13002
ACF2	0.15757	-0.12817	-0.08866
ACF3	0.13649	-0.07328	-0.05510
ACF4	0.12206	-0.02972	-0.04154
ACF5	0.10485	-0.00086	-0.00002
ACF6	0.09184	0.02327	0.03310
ACF7	0.07953	0.05105	0.04681
ACF8	0.06741	0.08212	0.04497
ACF9	0.06154	0.08993	0.06553
ACF10	0.05573	0.09918	0.07763
PACF2	-0.14453	0.36256	0.20436
PACF3	0.07349	-0.06440	0.00090
PACF4	-0.07065	0.31173	-0.05977
PACF5	-0.03921	0.00757	0.54036
PACF6	-0.04210	0.19831	0.00573
PACF7	-0.03129	0.20387	-0.07919
PACF8	-0.06640	0.27320	-0.10903
PACF9	-0.00462	-0.09241	0.50533
PACF10	0.00122	0.15205	-0.24872

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TABLE 6. Analysis of Variance table for the ACF's and the PACF's of the [illegible]0 scan lines transformed by the first three factor score coefficients. Values reported are the probability of exceeding the observed F-ratio when the null hypothesis is correct.

Source	Error Term	D.F.	Dependent Variable: Factor 1	Factor 2	Factor 3
1. Mean	Location	1	1.0000	1.0000	1.0000
2. Location		1			
3. Channel	LC	3	0.3148	0.2964	0.0367
4. T(L)	TA(L)	6	0.0000*	0.0832	0.3537
5. A(L)	TA(L)	8	0.2112	0.0533	0.0719
6. LC		3			
7. TC(L)	TCA(L)	18	0.0002*	0.1795	0.0025
8. TA(L)	R(LTCA)	24	0.0000*	0.0000*	0.0053
9. CA(L)	TCA(L)	24	0.0109	0.7991	0.3905
10. TCA(L)	R(LTCA)	72	0.0007*	0.0071	0.5480
11. R(LTCA)		160			

*Significant at the (distributed) 5% level computed as: final 5% alpha level/ 21 tests implies .00238 probability for each test.

effect per se is seen in either or these factors. The track by area influence is shown to be the most important one present. Examination of figures 3 and 4 for the Denver and Richmond areas shows how this influence may arise. In particular it can be seen that the image itself covers two totally distinct physiographic regions. As can be seen also the fifth area in track two goes into the second physiographic region and therefore it can be anticipated that if terrain is the signicant influence on these values the track effect will be significant, the area effect will be significant and the track-by-area interaction will be significant. All of these are seen in the analysis of variance. And therefore because the exact area to be examined in this study is entirely included within a single physiographic region all of the scan lines to be examined are assumed to have a constant autocorrelation structure and therefore it is appropriate to keep the sampling technique identical for all regions studied in both Denver and Richmond.

The sampling technique chosen was to obtain samples for the 'diffuse' technique at intervals separated by at least 9 pixels. This was following the suggestion made by Craig (1979) that such a sampling technique would yield independent pixels for examination of problems such as classifier accuracy evaluation. Thus the criterion used in finding the exact samples to be used for obtaining training and testing pixels for the diffuse technique was to have samples separated by at least nine pixels from any other sample used in the analysis. Using this method we can be fairly confident that each sample represents a distinct estimate of the characteristics of the land cover class. In this way each sample will contribute a full degree of freedom to the overall estimate of classifier accuracy.

4. Source of Photo-Interpreted Data

The photo interpretated data were made available by D. Toll of NASA's Goddard Space Flight Center on a transparent overlay for each quadrangle studied (see Appendix C.1). Within each quadrangle nine or twelve sites were chosen in which to study the classifier accuracy. Areas for study were chosen to uniformly cover each quadrangle on a grid dimensioned three columns by four rows in the case of Richmond and three columns by three rows in the case of Denver. The actual arrangement is shown in figure 10.

To construct a data set for the accuracy test, a grided overlay where each grid point was scaled to the size of the LANDSAT pixel (which itself had been redimensioned to a 1:24000 scale) was placed upon the transparent photo-interpreted land cover overlay. A symbol representing the appropriate land cover class was recorded and later input to a computer program for storage. The land cover classes actually considered are listed in table 7. A representative land cover test grid for each of the two regions is presented in figure 11. The entire set of land cover data grids used in this analysis is given in Appendix D.1. After the data were keyed into this program a printout of the same data was made and it was again compared to the photo-interpreted overlay. This was done by producing the print out at the same scale as the LANDSAT data so they could be placed directly under the overlay and compared to insure that the symbol assigned corresponded to the region of land cover that had been defined. Any errors recognized at this time were corrected in the computer file, the entire grid printed out a second time and again checked against the land cover overlay. In this way approximately ten thousand values of land cover class were made available for the accuracy assessment.

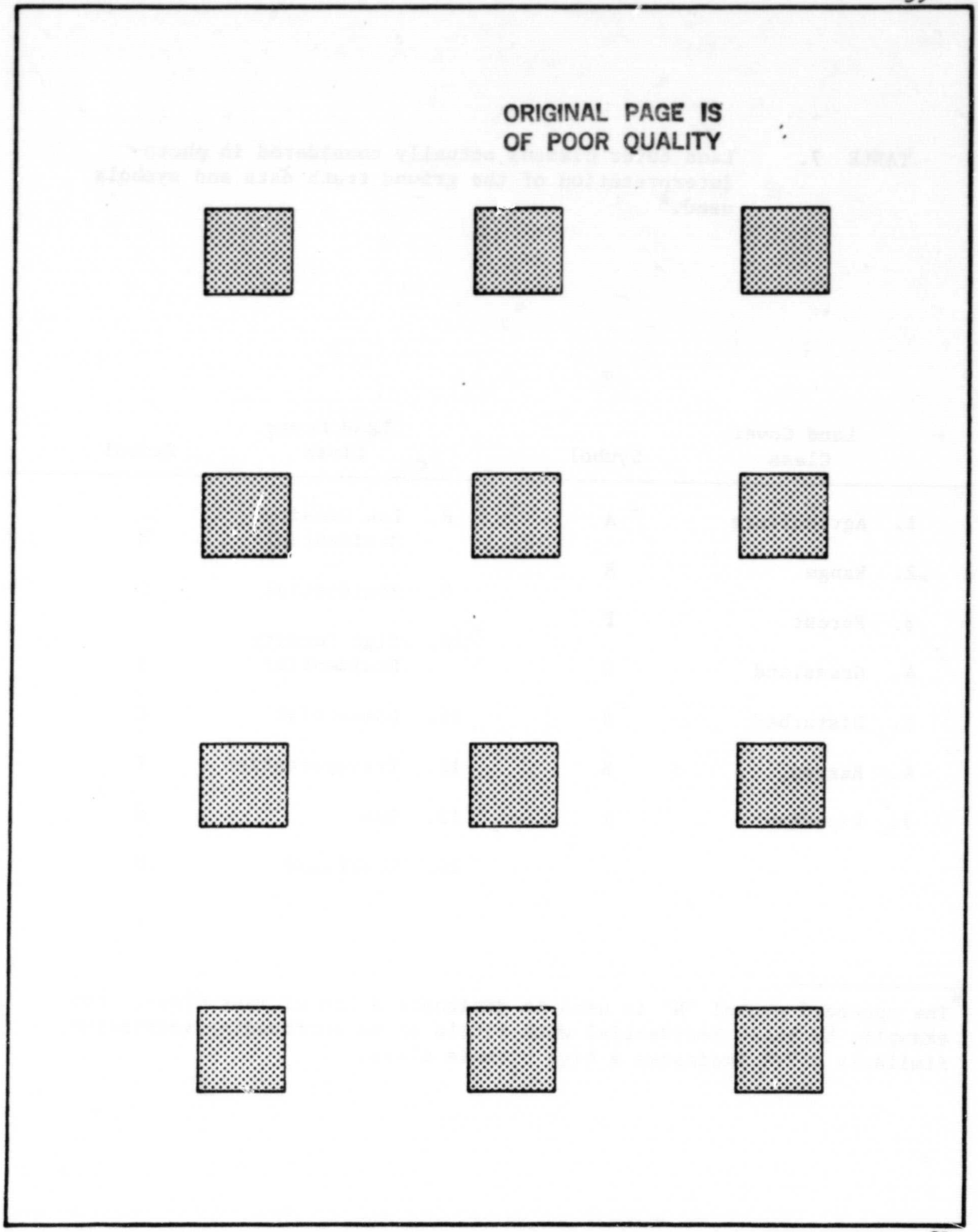

Figure 10. Arrangements of grids within the Chesterfield, Virginia area.

TABLE 7. Land cover classes actually considered in photo-interpretation of the ground truth data and symbols used.*

	Land Cover Class	Symbol		Land Cover Class	Symbol
1.	Agriculture	A	8.	Low Density Residential	M
2.	Range	R	9.	Residential	L
3.	Forest	F	10.	High Density Residential	H
4.	Grassland	G	11.	Commercial	C
5.	Disturbed	D	12.	Transportation	T
6.	Barren	B	13.	Dam	E
7.	Riparian	P	14.	Undefined	U

*The appended symbol "N" is used to designate a low biomass Class. For example, LN means Residential with little or no surrounding vegetation. Similarly a "+" indicates a high biomass class.

```
REGION...     CHESTERFIELD
    GRID..... 3

FFFFDDAAAAAAFFFL
LFFDFAAAAAAFFFFL
LLLDFAAAAAAAFFFLF
LFLFFFAAAAAAFFFF
LLLFFFFAAAAAFFFF
LLLFFAFAALLLAAAA
LLLFFAFFAALAAAAA
LLLLLLLLAAAAFFCC
LLLLLLLLLAFFFFCC
CCLLLLLLLFFFFFDD
LLLLLLLCCCCFTFDD
LLLLLLCCCCCDDFFF
AALLLLCCTCCDCDDF
```

Figure 11. A typical grid of land cover class symbols obtained by digitizing the photo-interpreted data. Chesterfield, Virginia grid number 3.

5. Definition of Two Methods of Developing the Signatures

The important question to be analyzed in this study is the question of how means of obtaining samples effect the estimate of accuracy obtained. Two different kinds of sampling techniques are being examined. One is that in which samples are obtained as usual. It is common to obtain samples in contiguous blocks since this is the most convenient means of obtaining them. A second method, which is argued in this study to be the more desirable one, is to obtain samples in such a way that each represents a totally independent estimate of the characteristics of the land cover class being examined. To evaluate the relative desirability of these we must design a test which allows us to answer the question: how does the means of obtaining samples affect the estimates of accuracy? To do this we will use two distinct methods for obtaining samples and evaluate the accuracy of classification results when each of these is used in turn; and then we will compare those two results.

In the first we will obtain groups of close contiguous blocks of pixels so that all pixels used to estimate a single signature are taken from a single very narrowly constrained contiguous group of pixels. In the second method we will 'diffusely' sample the land cover class from throughout the region where it is available. This we call the 'diffuse' sampling technique. Following this method no contiguous pixels will be used to estimate the vector of means for the classification. To obtain these independent samples they will each be taken from a distance of at least ten pixels from any other represemtive pixels used. Furthermore, because we need to estimate the variance-covariance matrix in addition to the vector of means it is necessary that all samples used to estimate the

reflectance characteristics of every land cover class by independent of all others. It is not sufficient that samples be independent within a given land cover class. Therefore to obtain the diffuse samples we will choose pixels so that they are a distance of at least ten pixels away from any other pixel used to define the signature of any other class in the analysis.

At least five distinct methods are available that would result in an accuracy evaluation which would presumably be satisfactory. These five methods are listed in table 8. In some we might test the accuracy of our evaluation by using the same kind of sampling technique to derive pixels for the test as we did to get the pixels for the training set. In others we would use the same evaluation procedure for both the diffuse and blocked examination. This would mean using either all blocked pixels to define our testing group, or alternatively using all diffuse samples to define the test group. It has been determined in this study to use all diffuse sampled pixels to define the testing of characteristic signatures (test number 2). The reason for this is that if there is no effect of autocorrelation whatsoever, either technique would be valid of course. On the other hand if there is an effect of autocorrelation presumably only the diffuse method would be satisfactory. Therefore since we are allowing the alternative that autocorrelation does significantly affect the results it is prudent to use the diffuse technique for examination of both classifier techniques.

Other constraints on the total examination procedures to be used for both the diffuse and block sampling techniques are as follows. First of all we will want to use the same number of pixels for each test, diffuse and blocked. We will also want to use the same number of pixels for both

TABLE 8. Some alternative strategies available for testing classifier accuracy using blocked and/or diffuse sampling.

Method of Testing

Test Number	Blocked Trained Signatures	Diffuse Trained Signatures	Choice of Pixels
1.	Blocked	Diffuse	Different
* 2.	Diffuse	Diffuse	Different
3.	Blocked	Blocked	Different
4.	Blocked	Blocked	Same, single entire grid
5.	Diffuse	Diffuse	Entire set of 33 grids

*Method actually chosen for this study.

developing the training statistics and for testing the accuracy of the two techniques. We will want our examination to be independent for training and testing;that is we do not want to use the same pixels for each. Therefore we divide the total number of pixels available in half and apply one half of these to development of training signatures and one half to the testing itself. No overlap between these two groups is allowed. To minimize problems induced by geometric distortions in the satellite data we will avoid using any pixels which fall on the boundary of a group.

We will also subject ourselves to the constraint that the land cover classes used for the accuracy evaluation was to be present in both areas, Richmond and Denver. It is not enough to evaluate the accuracy in one place only. This is because the degree of autocorrelation may be different in the two areas. It may be significant in one and not in the other. Therefore we will not only want to compare the two techniques but we will want to compare their relative efficiency in both areas. Furthermore we must have at least ten pixels available in each land cover class to be examined. This is a minimum number for which we can hope to have useful statistics developed on the relevant accuracy of the two techniques.

Finally the number of pixels used in each land cover class must be in proportion to, and so representatives of, the relative proportion in the total population. This is important in order to minimize any possible bias which could be introduced in the evaluation of both type I and type II errors as is necessary in examinations of this type. As is shown below the set of all these constraints which have been applied, all of which are very reasonable, has produced very definite limits on the extent to which accuracy evaluation can be performed in these two areas.

6. Input and Analysis of Photo-Interpreted Data

The next step was to determine the total number of pixels available for each of the two types of accuracy assessment. On the one hand it was desired to obtain a group of pixels at the closest possible spacing to use to develop the signature for land cover classification. In the other case it was desired to choose pixels for each land cover class subject to the constraint that they be placed no closer than 10 pixels apart. For the purpose of the development of the first signature a program was written to find, from each of the land cover grids now available in computer storage, the largest blocks of contiguous pixels that could be obtained. To avoid the problem of 'mixed pixels' -- in which a given pixel cannot be accurately assigned to any single land cover class but instead contains a contribution from several of those classes -- it was desired to avoid any pixels which were on the boundaries of a given block of contiguous identical land cover pixels. Thus the program was designed to discover the largest blocks of contiguous pixels available, of the same land cover class, subject to the constraint that no border pixels (that is pixels adjacent to a pixel of another land cover class) were included within the first contiguous block. The program was designed to output a new grid in which each block of contiguous pixels was assigned a unique alphabetic symbol (figure 12). In addition the total number of pixels within that contiguous block, except for those on the border of the block, was printed. An example is given in table 9. A summary of the information for all of the grids used in the analysis is presented in table 10. Examination of the data in table 10 shows that there are very few land cover classes for which large blocks of contiguous pixels are available to be sampled. There are a large number

```
AAAABBCCCCCCDDDE
FAABACCCCCCDDDDE
FFFBACCCCCCDDDED
FGFAAACCCCCCDDDD
FFFAAAACCCCCDDDD
FFFAAHACCIIICCCC
FFFAAHAACCJCCCCC
FFFKKKKKCCCCLLMM
FFFKKKKKKCNLLLMM
OOKKKKKPPNNNLLQQ
RRRRRRPSSSSNTLQQ
RRRRRRSSSSSUULLL
VVRRRRSSWSSUXUUL
```

Figure 12. Results of program BLKFND representing each block of contiguous pixels of a single land cover class by a unique symbol. Chesterfield, Virginia, grid number 3.

TABLE 9. Example of counts of number or blocks of each land cover class produced by the program BLKFND.

REGION...RICHMOND CHESTERFIELD
GRID... 3

BLOCK	CHARACTER	LAND COVER	NUMBER
1	A	F	22
4	D	F	19
7	G	F	1
12	L	F	12
14	N	F	5
2	B	D	4
17	Q	D	4
21	U	D	5
3	C	A	47
8	H	A	2
22	V	A	2
5	E	L	3
6	F	L	21
10	J	L	1
16	P	L	3
18	R	L	16
9	I	L-	3
11	K	L-	16
13	M	C	4
15	O	C	2
19	S	C	13
24	X	C	1
20	T	T	1
23	W	T	1

TABLE 10. Total numbers of pixels of each land cover class present in the study grids.

	Land cover class	DENVER Fitzsimmons	RICHMOND Chesterfield	Seven Pines	Total
1	L	967	195	373	568
2	L^-	12	97	88	185
3	HN	52	0	1	1
4	C	418	48	23	71
5	CN	96	26	1	27
6	B	369	3	108	111
7	D	668	55	185	241
8	G	258	0	5	5
9	A	467	328	460	791
10	T	83	37	64	101

of blocks which contain only a few non-border pixels. The program used for this analysis is also included in Appendix A , it is called BLKFND. The raw data are listed in Appendix E.1.a.

In the same way it was desired to obtain a second collection of pixels to use for developing signatures for training the classifier and for testing the accuracy of the classifier. These pixels were desired so that they were not contiguous pixels. That is, that they would not be subject to the autocorrelation known to exist within the LANDSAT data. To obtain such samples it was necessary that they be no closer than ten pixels distant from the remainder of the pixels used in this part of the analysis. They were of course subject to the same constraint as the contiguous pixels chosen. That is they could not be on the border of any given blocks of pixels of a given land cover class. Rather, they must be in the interior of a homogeneous group of pixels. To obtain samples of this type a computer program was written to locate all pixels within each of the grid blocks of photo-interpreted pixel data available for the test. The program was designed to locate pixels which were not on the border of the class block (figure 13) and which fell at least ten pixels from the nearest pixel within the entire grid which had already been chosen for potential analysis. In this way a reasonable number of pixels were located which could be used for this part of the autocorrelation study. An example of the output of this program is shown in figure 14. The remainder of the results of this program analysis are given in Appendix E.1.b. The program used for this analysis, called DIFIND, is also given in Appendix A .

Once all of these data were obtained by the computer runs, it was desired to determine the total number of pixels which would be available for each of these types of classification and testing runs.

```
REGION...RICHMOND     CHESTERFIELD
GRID..... 3

PIXELS NOT ON THE BORDER OF A CLASS BLOCK

0000000111000100
0000000111000000
0000000111000000
0000000011000000
0000000000000000
1100000000000000
1100000000000000
1100000000000000
0000110000000000
0000000000000000
0000000000000000
0001100000000000
0001100000000000
```

Figur. 13. Results of program DIFIND showing those pixels on the borders of contiguous blocks of a single land cover class (0's), and those not on the border of a block (1's). Chesterfield, Virginia, grid number 3.

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LOCATIONS OF SAMPLES USEABLE AT A DISTANCE OF 9

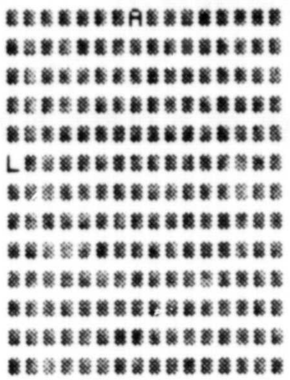

Figure 14. Results of program DIFIND showing non-border pixels available for training or testing and at least ten pixels distant from any other pixels chosen. Chesterfield, Virginia, grid number 3.

The total of all of the pixels available for the diffuse technique for each quadrangle and land cover class are listed in table 11. As can be seen by examining this table, certain land cover classes do not occur in both Richmond and Denver. Therefore only a small fraction of all of the distinct types of land cover were available for testing if the testing were desired to be done for each land cover in both areas, as was the case. Land cover classes with at least 10 pixels available in both areas are marked by an asterisk in table 11. Pixels available for each land cover class in each of the areas using the blocked sampling technique were shown in table 10. As can be seen by comparison of these two tables, and as would be expected, many more pixels are available using the 'blocked' technique than are available when using the 'diffuse' sampling. When we limit our consideration to those land cover classes for which a minimum of ten pixels are available in each of the two regions, Denver and Richmond it can be seen that only two distinct land cover classes are available for sampling. These are the 'residential' and the 'agricultural' classes. For each of these classes a large sample set is also available using the blocked technique as would be expected. Because of the severe constraint that the diffuse sampling scheme imposes on the number of pixels available we shall limit our investigation of classification accuracy to the two above mentioned land cover classes.

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TABLE 11. Total number of pixels available at a spacing of nine, and completely surrounded by similar pixels.

	Land cover class	Fitzsimmons	Chesterfield	Seven Pines	Total Richmond
1.*	L	18	2	8	10
2.	L^-	0	3	1	4
3.	HN	2	0	0	0
4.	C	9	1	0	1
5.	CN	1	0	0	0
6.	B	5	0	2	2
7.	D	15	0	1	1
8.	G	4	0	0	0
9.*	A	11	9	7	16
10.	T	1	0	0	0
11.	F	0	28	22	50
12.	H	4	0	0	0
13.	R & R+	14	0	0	0
14.	LN	7	0	0	0

*Classes for which at least 10 pixels are available in both regions.

7. Choice of Training Pixels

Once the land cover classes of interest were determined it was next desired to find the correct number of pixels of each of the land cover classes to be examined. In fact, there were to be three land cover classes, the two mentioned and a third land cover class, 'other', consisting of the total of the remaining land cover classes. A necessary requirement for accuracy evaluation is that the pixels used in the assessment of accuracy be representative of the relative proportion of the land cover which exists in the population which we are trying to represent. We estimate the actual percentage of the region covered by a given land cover class by the total number of pixels detected by the photo-interpretation method within the grids which were examined. Using this technique for example for Denver it was found that approximately 20% of the entire area under consideration is covered by the land cover class 'residential'. Similarily it is found that approximately 12% of the area is in the 'agricultural' land cover class (table 12; see also table 13 for Richmond). The remainder of the pixels naturally fall in the land cover class 'other'. For the land cover class 'residential', a total of 18 pixels were available for the diffuse sampling evaluation, for 'agriculture' a total of 11 pixels were available (table 11). Half of these pixels were to be used for the training and half were to be retained for an independent testing assessment; therefore nine residential and five agricultural pixels were to be used in the diffuse sample for training. It was desired that these would be a proportion of the total number of pixels used representative of their contribution to the overall population of land cover classes. In fact then eight pixels were used in the residential class in Denver for testing and eight were used for training.

TABLE 12. Frequency of occurrence of each land cover class in the Denver area and numbers of pixels chosen for examination.

Land cover class	Total number of pixels present	Desired percentage of grid represented by this cover	Number of samples desired	Number of samples taken
L	967	20	8.33	8
C	418	9	3.75	4
U	33	1	.42	0
B	369	8	3.33	3
A	567	12	5	5
D	737	15	6.25	6
H	134	3	1.25	1
HN	52	1	0.42	0
LN	322	7	2.92	3
CN	96	2	0.83	1
R+	103	2	0.83	1
R	746	15	6.25	6
L^-	12	0	0	0
G	258	5	2.08	2
H^-	5	0	0	0
LD	1	0	0	0
T	83	2	0.83	1
E	5	0	0	0
N	6	0	0	6
F	0	0	0	0
W	0	0	0	0
	4914			41

TABLE 13. Frequency of occurrence of each land cover class in the Richmond area and numbers of pixels chosen for examination.

Land cover class	Total number of pixels present	Desired percentage of grid represented by this cover	Number of samples desired	Number of samples taken
L	568	0.11	5.5	5
C	71	0.01	0.5	1
U	0	0.00	0.0	
B	111	0.02	1.0	1
A	791	0.16	8.0	8
D	241	0.05	2.5	3
H	0	0.00	0.0	
HN	1	0	0	
LN	0	0.00	0.0	
CN	27	0.01	0.5	1
R+	0	0.00	0.0	
R	0	0.00	0.0	
L$^-$	185	0.04	2.0	2
G	4	0	0	
H$^-$	0	0.00	0.0	
LD	0	0.00	0.0	
T	101	0.02	1.0	1
E	0	0.00	0.0	
N	0	0.00	0.0	
F	2891	0.58	29.0	29
W	1	0	0	
	4992			51

In the same way five pixels of the agricultural class were used for testing and five for training. The coordinates of the pixels chosen for this analysis are listed in table 14. In order to maintain the appropriate relative proportion of the total population, the class 'other' was designed to comprise twenty-eight pixels total in each of the training and the testing procedures. Similar computations were done for the case of Richmond and it was found that five 'residential' pixels and eight 'agricultural' pixels would be required. To keep the correct proportion of these to the overall land cover a total of 38 pixels from 'other' land cover classes were used. These again are used in proportion to their representation in the population as estimated from the total grid sample available. The actual representation of different land cover classes in the class 'other' is included in tables 12 and 13. These tables also list the exact number of samples which were desired. Having the land cover class 'other' available and having the proportions of three land cover classes being representative of the population makes it possible to perform an unbiased accurate evaluation of both type I and type II errors during the classification procedure. For each land cover class in each area a block of the same number of pixels was chosen at random to develop the blocked statistics. The coordinates of these blocks are given in table 15.

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TABLE 14. Coordinates of pixels chosen for training statistics for classifier, difuse method.

	Richmond		Denver	
Residential	Scan line	Element	Scan line	Element
	1145	1861	2188	2152
Seven Pines	1107	1906	2171	2209
	1142	1916	2183	2259
			2189	2252
Chesterfield	1198	1495	2213	2152
	1199	1587	2213	2162
			2218	2214
			2227	2210
			2213	2248
			2222	2244
Agriculture				
Seven Pines	1061	1960	2171	2145
	1071	1949	2188	2140
			2171	2244
Chesterfield	1205	1544	2171	2263
	1195	1593	2179	2249
	1244	1499	2187	2244
	1236	1544		
	1240	1598		
	1283	1491		
	1280	1549		

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TABLE 15. Coordinates of pixel groups used to develop signatures for 'blocked' sample classification method.

	Number of Pixels	Beginning Scan line	Ending Scan line	Beginning Element	Ending Element
Residential	3	1109	1111	1908	1908
Richmond	2	1110	1111	1909	1909
(Seven Pines)	5				
Agriculture	9	1029	1030	1907	1910
Richmond					
(Seven Pines)					
Residential	6	2221	2223	2211	2212
Denver	4	2221	2224	2213	2213
	10				
Agriculture	6	2179	2180	2245	2247
Denver					

8. Results of STATS Runs

Once the total number of points which were to be used in the development of signatures and in the accuracy evaluation were determined, those pixels were identified and a statistics package program of the ORSER system used to develop signatures for the classification. This was done with half of the total number of pixels that had been identified and chosen as representative pixels for each of the two techniques. Separate statistics were developed for each of the two regions, Denver and Richmond. These statistics consisted of the mean and standard deviation for each of the four channels of the satellite data.

Because of the nature of the stats program used in this analysis separate classification signatures had to be developed for each of the two quadrangles in the Richmond area. For the purposes of this study both of these quadrangles were assumed to be random samples of identical land cover class types and therefore it was appropriate to combine the signatures developed for each of those two quadrangles to construct a single signature appropriate for the entire Richmond area. To obtain the most useful signature it was necessary to combine the two values, since those values were constructed using different sample sizes it was not possible to simply average the signatures for each channel. Rather,a weighted average had to be done. In the same way, it was necessary to extract from the computed variances the actual sums of squares for each channel for each quadrangle. From these sums of squares and from the computed means it was possible to construct an overall estimate of population variance based on the combined variances for each channel for the two quadrangles. These individual signatures and the combined calculated signatures for the two

quadrangles are listed in table 16. To expedite these computations a short computer program was written and this program, called SIGNAD, is listed in Appendix A also. Using the combined signatures which have not been developed it is possible to create plots of the classification space to show where these signatures will fall. Figures 15 and 16 illustrate the regions of classifications space for each of the two techniques, DIFFUSE and BLOCKED, for the Denver area.

The classifier that was chosen to be used with this analysis was one of the ORSER system called PPD. This is a parallelopiped classifier in which the classification space is divided into hyper-rectangles. The limits on the rectangle dimensions were defined by the mean for each channel plus or minus two times the standard deviation for that channel. These values were computed for each of the two areas and are listed in table 17.

Prior to running PPD on the LANDSAT data each area (quadrangle) was geometrically corrected, rotated and rescaled (to 1:24000) using the ORSER program SUBGM. These areas were then output as symbol maps to scale with the ORSER program NMAP. The quadrangles were compared directly to standard USGS 7½' quadrangle maps to exactly locate the testing grids in the LANDSAT imagery. Whenever necessary the 'fine correction factor' of the SUBGM program was employed to bring the imagery into precise alignment with the quadrangle map. In each case agreement within ±½ pixel was achieved.

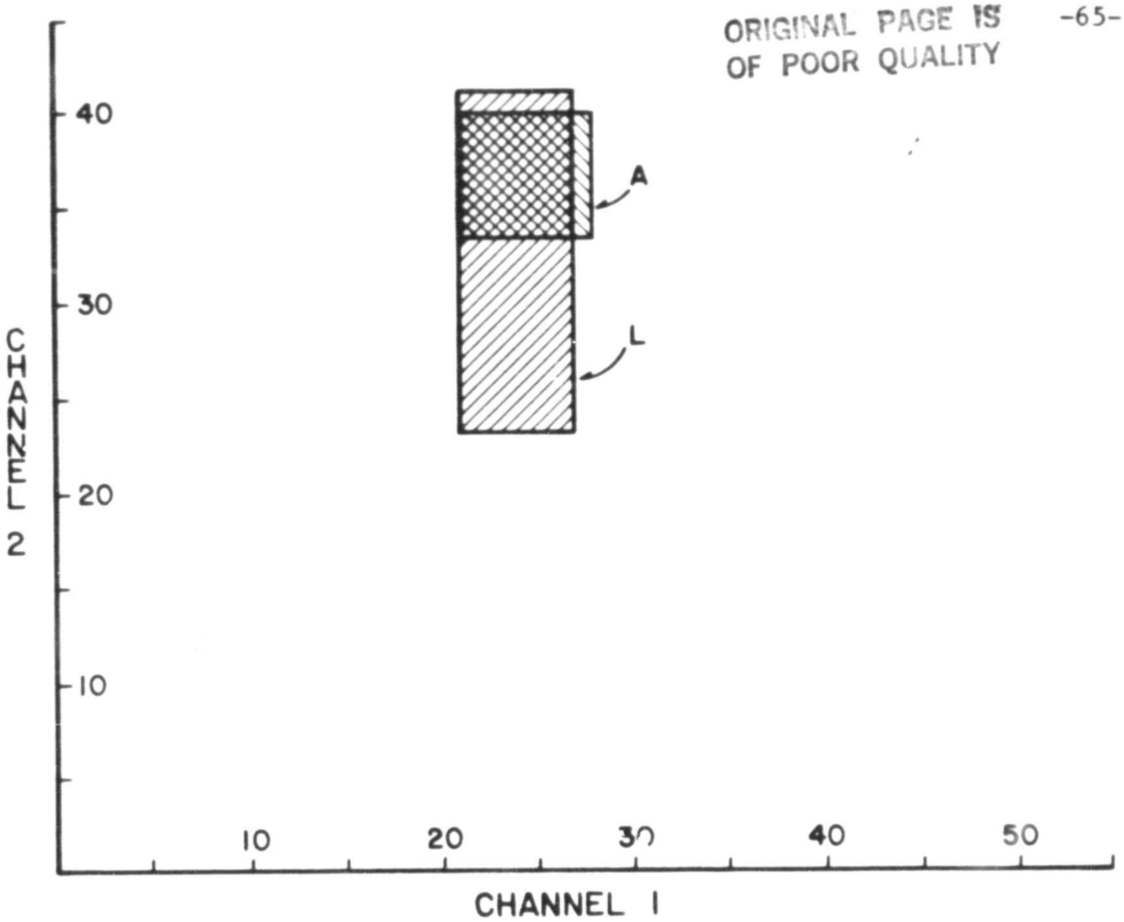
Next the transparent photo-interpretation overlay for the area on which the quadrangle boundaries were marked was placed over the image map to determine the exact coordinates of the grids available for testing. These grids and quad boundaries were marked directly on the LANDSAT pixel map so that the photointerpretation overlay could be repositioned at any

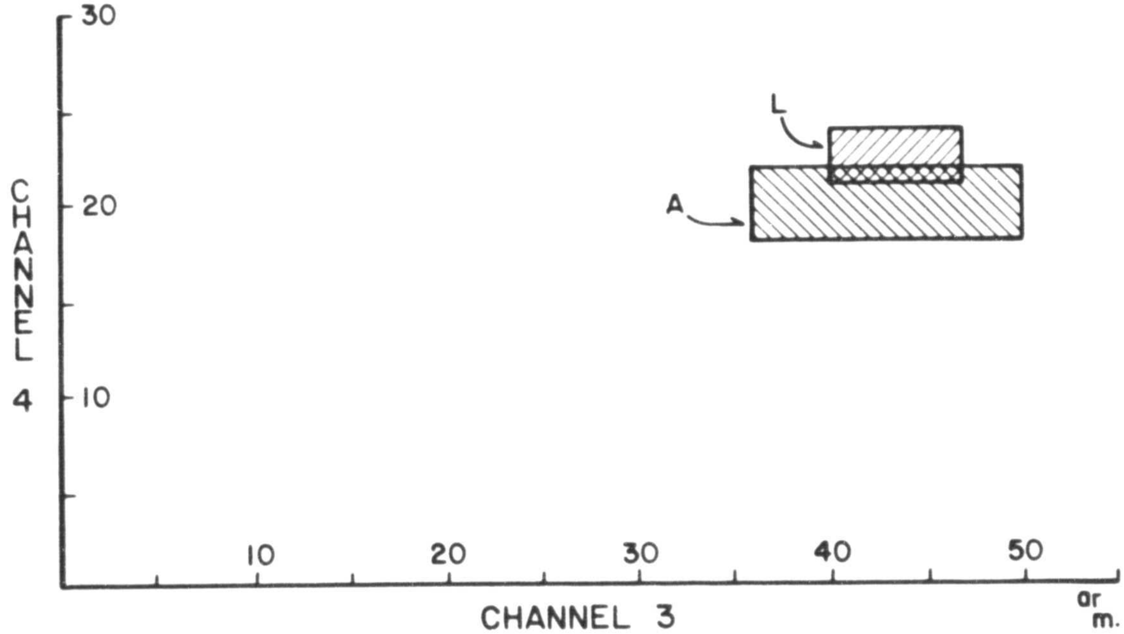
Table 16. Statistics of signatures developed from training pixels for each of the classification methods.

Source	Method	N	Land Cover	Channel Values: Means 1	2	3	4	Standard Deviations 1	2	3	4
Denver	Diffuse	10	Residential	22.40	28.20	40.20	21.50	3.03	4.83	2.78	1.72
		6	Agriculture	23.67	32.83	38.17	18.83	2.42	1.17	3.87	1.60
	Blocked	10	Residential	24.30	31.60	43.40	22.60	1.70	4.70	1.96	1.17
		6	Agriculture	24.50	36.33	43.00	20.00	1.87	2.07	3.90	1.41
Chesterfield	Diffuse	2	Residential	15.00	18.00	27.50	16.00	2.83	0.00	3.54	1.41
		7	Agriculture	15.14	17.00	25.57	15.29	1.57	2.31	3.64	1.98
	Blocked		Residential*	--	--	--	--	--	--	--	--
			Agriculture*	--	--	--	--	--	--	--	--
Seven Pines	Diffuse	3	Residential	16.67	16.63	27.00	15.33	2.31	4.73	3.61	1.53
		2	Agriculture	20.00	24.50	31.50	17.00	2.83	3.54	3.54	1.41
	Blocked	5	Residential	17.00	17.60	28.00	15.00	2.55	2.97	2.45	1.00
		9	Agriculture	18.11	23.44	27.00	14.89	0.60	1.74	1.94	1.36
Both	Diffuse	5	Residential	16.00	17.00	27.20	15.60	2.35	3.46	3.11	1.34
Richmond		9	Agriculture	16.22	18.67	26.89	15.67	2.73	4.06	4.28	1.94
Quads	Blocked	5	Residential	17.00	17.60	28.00	15.00	2.55	2.97	2.45	1.00
Combined		9	Agriculture	18.11	23.44	27.00	14.89	0.60	1.74	1.94	1.36

*Statistics for blocked samples were not developed for this quadrangle since no blocks were chosen from it.

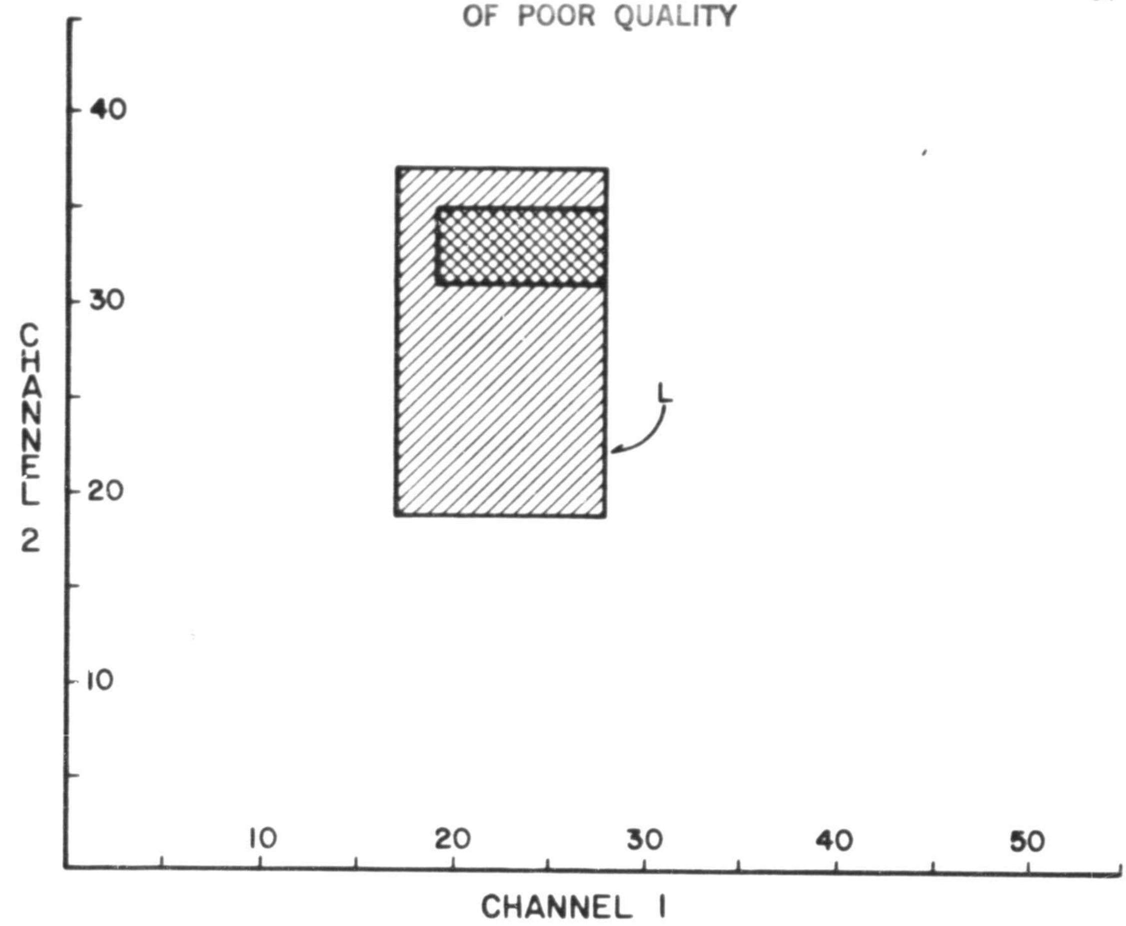
Figure 15. Regions of the brightness space which could be classified as agriculture (A) and residential (L) using the blocked sampling scheme to develop signatures. (a) channels MSS-4 and MSS-5, (b) channels MSS-6 and MSS-7. Cross-hatched region is the area of confusion of the two land cover classes. Fitzsimmons quadrangle, Colorado.

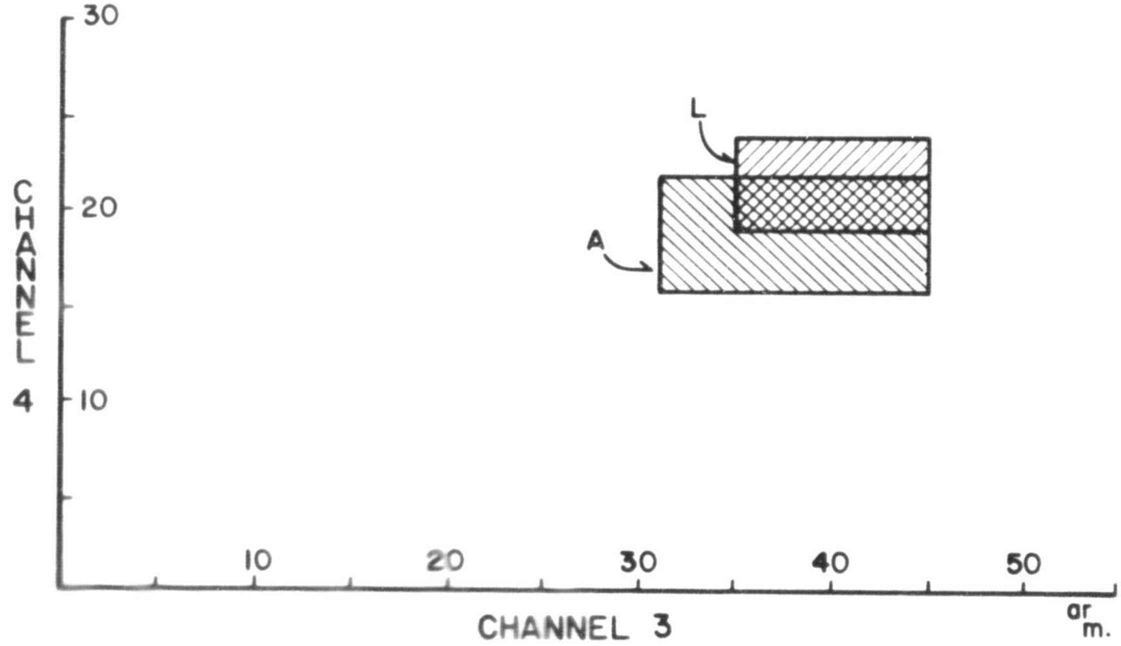

A
L
40
30
20
10
CHANNEL 2
10
20
30
40
50
CHANNEL 1


L
A
30
20
10
CHANNEL 4
10
20
30
40
50
CHANNEL 3

or
m.

Figure 16. Regions of brightness space which could be classified as agriculture (A) and residential (L) using the diffuse sampling scheme to develop signatures. (a) channels MSS-4 and MSS-5, (b) channels MSS-6 and MSS-7. Cross-hatched region is the area of confusion of the two land cover classes. Fitzsimmons quadrangle, Colorado.


40
30
20
10
CHANNEL 2
L
10
20
30
40
50
CHANNEL 1


30
20
10
CHANNEL 4
L
A
10
20
30
40
50
CHANNEL 3

ar
m.

TABLE 17. Classification limits for each land cover class in each region classified by PPD.

Region	Land Cover	Training Type	Limit	Channel 1	Channel 2	Channel 3	Channel 4
Richmond	Residential	Diffuse	Upper	20.69	23.93	33.43	18.28
			Lower	11.31	10.07	20.97	12.91
		Blocked	Upper	22.10	23.54	32.90	17.00
			Lower	11.90	11.66	23.10	13.00
	Agriculture	Diffuse	Upper	21.68	26.79	35.46	19.54
			Lower	10.76	10.54	18.32	11.80
		Blocked	Upper	19.31	26.92	30.88	17.61
			Lower	16.91	19.96	23.12	12.17
Denver	Residential	Diffuse	Upper	28.46	37.86	45.76	24.99
			Lower	16.34	18.54	34.64	18.06
		Blocked	Upper	27.70	41.00	47.32	24.94
			Lower	20.90	22.20	39.48	20.26
	Agriculture	Diffuse	Upper	28.49	35.17	45.91	22.03
			Lower	18.85	30.49	30.43	15.63
		Blocked	Upper	28.24	40.47	70.80	22.82
			Lower	20.76	32.19	35.20	17.18

time if discrepancies arose. The coordinates of the grids as determined with this technique are listed in tables 18, 19 and 20. The signatures were then input to the PPD program, and the entire quadrangle classified according to those values. Classification groups were residential, agriculture, and all other. Where the two land cover class types overlapped a separate symbol indicating confusion was printed out. An example of the results of the parallelopiped classifier for a single grid in the Richmond area is shown in figure 17.

TABLE 18. Coordinates of grids used in the Phase I Analysis of the Chesterfield, Virginia quadrangle.*

Grid Number	Beginning Scan Line	Ending Scan Line	Beginning Element	Ending Element	Number of Scan lines	Number of Elements
1	1194	1206	1537	1552	13	16
2	1194	1206	1586	1601	13	16
3	1195	1207	1488	1503	13	16
4	1233	1245	1538	1553	13	16
5	1233	1245	1586	1601	13	16
6	1234	1246	1488	1503	13	16
7	1272	1284	1588	1603	13	16
8	1273	1285	1539	1554	13	16
9	1274	1286	1490	1505	13	16
10	1311	1323	1589	1604	13	16
11	1312	1324	1540	1555	13	16
12	1313	1325	1491	1506	13	16

*Note that these coordinates are transformed from the original scan line and element numbers due to rotation, scaling and geometric corrections used in the ORSER program SUBGM.

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TABLE 19. Coordinates of grids used in the Phase I Analysis of the Seven Pines, Virginia quadrangle. *

Grid Number	Beginning Scan Line	Ending Scan Line	Beginning Element	Ending Element	Number of Scan lines	Number of Elements
1	1021	1033	1946	1961	13	16
2	1022	1034	1897	1912	13	16
3	1023	1035	1849	1864	13	16
4	1060	1072	1948	1963	13	16
5	1061	1073	1899	1914	13	16
6	1062	1074	1850	1865	13	16
7	1099	1111	1950	1965	13	16
8	1100	1112	1851	1866	13	16
9	1100	1112	1901	1916	13	16
10	1139	1151	1902	1917	13	16
11	1140	1152	1853	1868	13	16
12	1140	1152	1952	1967	13	16

*Note that these coordinates are transformed from the original scan line and element numbers due to rotation, scaling and geometric corrections used in the ORSER program SUBGM.

TABLE 20. Coordinates of grids used in the Phase I Analysis of the Fitzsimmon, Colorado quadrangle. *

Grid Number	Beginning Scan Line	Ending Scan Line	Beginning Element	Ending Element	Number of Scan lines	Number of Elements
1	2128	2148	2138	2163	21	26
2	2129	2149	2190	2215	21	26
3	2129	2149	2243	2268	21	26
4	2170	2190	2138	2163	21	26
5	2170	2190	2190	2215	21	26
6	2170	2190	2243	2268	21	26
7	2212	2232	2138	2163	21	26
8	2212	2232	2190	2215	21	26
9	2212	2232	2243	2268	21	26

*Note that these coordinates are transformed from the original scan line and element numbers due to rotation, scaling and geometric corrections used in the ORSER program SUBGM.

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FILE: LRCB3 (A)

```
RR RRRRR  R RRRR
RRRRRRRR  RRR RR
CR RRR RRR RR  R
C R  RR R  RRR C
C RRRRRRRRRRRR
RRRRRRRR RRR RRA
RRRRRRCRR RRCRC
RRRRRRRR  RC RC
R RRRR  RRRCCCR
RC R    RRRRCCRR
CC  C      RR  R
CRCCA      RR
RC           CRR
```

FILE: LRCD3 (B)

```
CCCCCCCCCACACCCC
CCCCCCCCACCCCCCC
CCCCCCCCCCCCCAAC
CCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCA
CCCCCCCCCCCCCCCA
CCCCCCCCCACCCCCA
CCCCCCCCAACCACCA
CCCCCC CCCCCCCC
CCACA   CCCCCCCC
CCCCCA  AACCCA C
CCCCA   A ACCCAC
CCAAA  A  A  CCC
```

Figure 17. A typical PPD classified LANDSAT image grid. Chesterfield, Virginia, grid number 3. (A) BLOCKED (B) DIFFUSE.

9. PPD Classifier Results

Actual classification of the LANDSAT data was done with a program obtained from the Office of Remote Sensing of Earth Resources (ORSER) at The Pennsylvania State University. This program is called PPD and is a parallelopiped classifier. Classification limits for this classifier were computed using the vectors of mean and standard deviations as obtained from the STATS Program. Limits were computed as the mean plus and minus two times the standard deviation in each of the four LANDSAT MSS data channels. All four channels were used since it was not obvious which channels would yield the best results and it was assumed that no degradation of classifier accuracy could result from the use of all available data.

Each of the grids whose coordinates are listed in tables 18, 19 and 20 were run separately through the PPD program. In addition entire maps of the quadrangles understudy were classified in order to yield an approximate measure of the quality of the classification. Reasonable accuracy appeared to be achieved in each case. Once the grids had been classified these classified values were output to a disk file on the Burroughs for later study. The classification produced a total of four symbols according to the following rule. If a pixel value fell within plus or minus two standard deviations of the mean in all four channels for a single land cover class it was classified as that class. Two classes were of concern in this study. The residential land cover was symbolized in the LANDSAT data by an "R", and the agricultural land cover class symbolized by "A". If a pixel had values which fell within the upper and lower two standard deviation limits on the mean in a given channel for both of these classes it was classified as a separate symbol "C" representing confusion or overlap between

the classes. Any pixel whose values did not fall in the upper and lower standard deviation limits on the mean was classified as other and given a symbol "blank". Once each grid had been classified and output to the disk on the Burroughs it was then transferred to the HP Mini Computer for analysis of classification accuracy. The classified grids which resulted from the PPD classification are given in Appendix F.1. Each of these grids was hand checked against the photo-interpreted data which had previously been digitized as described in section 6 above. The purpose of this checking was to determine if any blatant errors of mispositioning of grids had occurred, or if any errors had occurred in transfering the data to the mini computer. Once these checks were made, and they showed no errors, the data were then available for classification accuracy evaluation.

10. Accuracy Evaluation

To minimize the amount of operator induced inaccuracy in the evaluation procedure itself, a computer program was written in order to evaluate the accuracy in each of the grids. This was done by comparing the classifier results to the previously input photo-interpreted ground truth data. Accuracy evaluation, of course, was only considered for the pixels which had previously been choosen by the technique described above. These are listed in table 21. Accuracy was summarized in a confusion table following the method described by Kalensky and Scherk (1975). A summary of the overall accuracy evaluation results for Denver and Richmond is given in tables 22 and 23. There are a number of evaluation criteria available. As can be seen, the one chosen for major emphasis in this study was the value of overall mapping accuracy.

Overall mapping accuracy is defined as the ratio of the number of pixels correctly classified to the total number of pixels classified. Since essentially all (99%) of the land cover classes are represented in the set of pixels being evaluated, a type I error in one land cover class is a type II error in another and vice versa. Therefore it is not necessary to consider either type I or type II errors separately. Since the probability of making an error is just one minus the probability of correct classification, it is quite adequate for our purposes to simply consider the probability of a correct classification. Therefore overall classification accuracy is a representative measure of the success of a classifier in this study. It is the examination of these values which will be emphasized.

TABLE 21. Coordinates of pixels used for classifier accuracy evaluation ('testing').

	Richmond		Denver	
Residential	Scan line	Element	Scan line	Element
Seven Pines	1024	1850	2129	2139
	1033	1851	2129	2149
	1025	1898	2132	2158
	1066	1949	2172	2157
	1102	1915	2176	2148
			2181	2156
			2182	2141
			2188	2162
Agriculture				
Seven Pines	1025	1910	2144	2194
	1029	1953	2137	2244
	1063	1851	2138	2253
	1063	1909	2146	2245
	1103	1855	2147	2254
	1141	1860		
Chesterfield	1196	1490		
	1195	1544		

TABLE 22. Cumulative confusion table and measures of errors for the Fitzsimmons, Colorado quadrangle. (A) Blocked technique, (B) Diffuse technique.

CUMULATIVE CONFUSION TABLE

(A)

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	2	0	6	8	6	.75	.20
U	AGRICULTURE (A)	0	4	1	5	1	.20	.57
E	OTHER (O)	2	2	22	26	4	.15	.67
	TOTALS	4	6	29	39	11		
	COMISSIONS	2	2	7	11			
		.50	.33	.24				

OVERALL CLASSIFICATION ACCURACY .72 P(ALPHA ERROR)= .36

OVERALL MAPPING ACCURACY .60 P(BETA ERROR) = .37

CUMULATIVE CONFUSION TABLE

(B)

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	8	0	0	8	0	0.00	.57
U	AGRICULTURE (A)	1	1	3	5	4	.80	.13
E	OTHER (O)	5	3	18	26	8	.31	.62
	TOTALS	14	4	21	39	12		
	COMISSIONS	6	3	3	12			
		.43	.75	.14				

OVERALL CLASSIFICATION ACCURACY .69 P(ALPHA ERROR)= .44

OVERALL MAPPING ACCURACY .55 P(BETA ERROR) = .37

TABLE 23. Cumulative confusion table and measures of errors for the Chesterfield, Virginia quadrangle. (A) Blocked technique. (B) Diffuse technique.

CUMULATIVE CONFUSION TABLE

(A)

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	2	0	14	16	2	.13	.88
TOTALS		2	0	14	16	2		
COMISSIONS		2	0	0	2			
		1.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY .88 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY .77 P(BETA ERROR) = .04

CUMULATIVE CONFUSION TABLE

(B)

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	5	11	16	5	.31	.69
TOTALS		0	5	11	16	5		
COMISSIONS		0	5	0	5			
		0.00	1.00	0.00				

OVERALL CLASSIFICATION ACCURACY .69 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY .47 P(BETA ERROR) = .10

TABLE 23 (continued). Cumulative confusion table and measures of errors for the Seven Pines, Virginia quadrangle. (A) Blocked technique. (B) Diffuse technique.

CUMULATIVE CONFUSION TABLE

(A)

	CLASS		MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	1	0	4	5	4	.80	.08
U	AGRICULTURE	(A)	3	0	5	8	8	1.00	0.00
E	OTHER	(O)	5	1	11	17	6	.35	.42
TOTALS			9	1	20	30	18		
COMISSIONS			8	1	9	18			
			.89	1.00	.45				

OVERALL CLASSIFICATION ACCURACY .40 P(ALPHA ERROR)= .78

OVERALL MAPPING ACCURACY .31 P(BETA ERROR) = .72

CUMULATIVE CONFUSION TABLE

(B)

	CLASS		MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	0	5	5	5	1.00	0.00
U	AGRICULTURE	(A)	0	2	6	8	6	.75	.17
E	OTHER	(O)	0	4	13	17	4	.24	.46
TOTALS			0	6	24	30	15		
COMISSIONS			0	4	11	15			
			0.00	.67	.46				

OVERALL CLASSIFICATION ACCURACY .50 P(ALPHA ERROR)= .38

OVERALL MAPPING ACCURACY .40 P(BETA ERROR) = .66

The computer program used for this accuracy evaluation, called ABSTAT is listed in Appendix A . This program was run on each of the quadrangles and each of the grids within those quadrangles. A confusion table was output for each grid of each quadrangle and these are shown in Appendix G.1. Also computed was a cumulative misclassification table and the final cumulative misclassification table results are summarized in table 24. The actual selection of pixels to be used in the accuracy evaluation was performed through the use of the program TEST@. This program is also listed in Appendix A . Sufficient numbers of pixels were chosen so that the relative proportion of each land cover class within the total study area would be accurately represented. These pixels were of course also subject to the constraint that they not fall on the boundary of any given land cover class group as discussed previously.

As can be seen by examination of Table 24 and especially Table 25 no clear pattern can be seen in the results of the two classification procedures. In two of the three quadrangles the BLOCKED procedure led to slightly higher classification accuracy estimates. In the third quadrangle, the Seven Pines Quadrangle in the Richmond area, the DIFFUSE procedure led to a considerably greater overall classification accuracy. In all cases the standard deviation, as estimated using the classification accuracy in each grid of the quadrangle, is quite large. It is clear that none of these results indicate significant differences in the relative accuracy of the two techniques. Because the Richmond area was considered to be a whole unit rather than comprised of two separate regions, the results were combined and the overall average is also reported in Table 25. As can be seen in this case the DIFFUSE procedure led to an overall mean slightly higher in

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TABLE 24. Results of the examination of classifier accuracy in each area using the blocked and diffuse training procedure.

Quadrangle	Overall Classification Accuracy Blocked	Diffuse	Grid
Fitzsimmons	0.50	0.83	1
	0.83	0.50	2
	0.83	0.33	3
	0.33	1.00	4
	1.00	0.67	5
	0.67	0.67	6
	0.67	0.67	7
	1.00	1.00	8
	1.00	1.00	9
Chesterfield	1.00	0.50	1
	0.50	1.00	2
	0.00	1.00	3
	1.00	0.33	4
	1.00	1.00	5
	1.00	1.00	6
	1.00	0.50	7
	1.00	0.50	8
	--	--	9
	--	--	10
	--	--	11
	--	--	12

TABLE 24. (continued)

Quadrangle	Overall Classification Accuracy Blocked	Diffuse	Grid
Seven Pines	0.25	0.25	1
	0.00	0.00	2
	0.50	0.50	3
	0.33	0.67	4
	0.00	0.50	5
	0.67	0.33	6
	0.00	0.50	7
	0.00	0.00	8
	1.00	0.33	9
	0.33	0.67	10
	0.33	1.00	11
	1.00	1.00	12

TABLE 25. Summary of overall classifier accuracy for each quadrangle.

Quadrangle	Method	Mean	Standard Deviation
Fitzsimmons	Blocked	0.76	0.24
	Diffuse	0.74	0.24
Chesterfield	Blocked	0.81	0.37
	Diffuse	0.73	0.30
Seven Pines	Blocked	0.37	0.37
	Diffuse	0.48	0.33
Richmond Total	Blocked	0.55	0.42
	Diffuse	0.58	0.33
Overall Total	Blocked	0.72	
(Weighted Mean)	Diffuse	0.69	
Overall Accuracy	Blocked	0.635	
(Single Table)	Diffuse	0.624	

C-2

accuracy than the BLOCKED procedure. Again the standard deviations are very large and undoubtedly these means are not significantly different. The overall weighted means of the three quadrangles, including both the Richmond and Denver areas, are reported in Table 26. It can be seen that this procedure estimates the overall classification accuracy of the BLOCKED procedure is slightly higher than that of the DIFFUSE procedure. No estimate of the error variance is possible for this value. Finally a more appropriate overall measure of accuracy of evaluation can be obtained by combining the misclassification tables of all three quadrangles prior to computation of a single value of classification accuracy. This was done and that result is also reported in Table 25. Again the BLOCKED procedure led to a very slight improvement over that of the DIFFUSE technique. Undoubtedly these values could not be shown to be significantly different. Unfortunately estimates of the error variance are not available for these values.

Although not strictly statistically appropriate, multiple t-tests were performed to compare the means of each technique in each quadrangle. An adjustment of the overall alpha level was made to account for the fact that a number of tests were being performed so that an overall error level of 5% would be achieved. With this adjustment it could not be shown that any mean was significantly different than the other, BLOCKED or DIFFUSE, in any of the three quadrangles. Similarily tests of the homogeneity of variance of the techniques can be performed using an F-statistic. This was done for each of the three quadrangles and it was found that there is a slight tendency for the variance in classification accuracy to be larger in two (the Richmond two) of the three quadrangles. Although these tests

TABLE 26. Results of classifier accuracy test for the phase I study areas.

Weighted mean of classifier accuracy	Sample Size	Method	Quadrangle
0.72	39	Blocked	Fitzsimmons
0.69	39	Diffuse	Fitzsimmons
0.40	30	Blocked	Seven Pines
0.50	30	Diffuse	Seven Pines
0.88	16	Blocked	Chesterfield
0.69	16	Diffuse	Chesterfield
0.64	85	Blocked	Total
0.62	85	Diffuse	Total

can only be considered approximate at best, they indicate quite strongly that neither of the techniques can be anticipated to yield better classification procedures than the other. However, our certainty of the classification accuracy may be improved by the DIFFUSE sampling procedure.

Other means of evaluating classification accuracy are of course available. These would include computation of the alpha error rate, the beta error rate, mapping accuracy and overall mapping accuracy and all of these values have been included in the tables of Appendix G.1. Undoubtedly sufficiently thorough examination of all of these could uncover differences in the two techniques. However the testing becomes superfluous when such a large number of different classification evaluation procedures are considered. The number of tests is so great that an alpha error can be almost guaranteed to occur. Therefore no further statistical analyses of these values was made.

It is also conceivable that the relative classification accuracy of one technique or the other may decrease as a function of distance from the site where the training pixels were obtained. This hypothesis was considered and evaluated by graphical representation of the results (table 27) as a function of distance from training pixels. No systematic pattern could be uncovered in this procedure although there were hints that it maybe the case for the BLOCKED procedure. This is not surprising in that the BLOCKED procedure obtained all of its samples from a single site whereas the DIFFUSE procedure obtained pixel training samples from almost every grid within each quadrangle. Therefore it would be erroneous to conclude that the DIFFUSE method was superior to the BLOCKED method because of any patterns such as this that may exist. Further examination of the question however seems to be warranted.

TABLE 27. Results of overall classification accuracy for each Phase I area arranged according to the spatial configurations of the grids (as in figure 4). Grids in which samples were obtained are enclosed in brackets.

	Blocked			Diffuse		
Denver	0.50	0.83	0.83	0.83	0.50	0.33
	0.33	1.00	[0.67]	[1.00]	[0.67]	[0.67]
	0.67	[1.00]	1.00	[0.67]	[1.00]	[1.00]
Seven Pines	0.25	0.00	0.50	0.25	0.00	0.50
	0.33	0.00	0.67	0.67	0.50	[0.33]
	0.00	[0.00]	1.00	0.50	[0.00]	0.33
	0.33	0.33	1.00	[0.67]	[1.00]	1.00
Chesterfield	1.00	[0.50]	0.00	[0.50]	[1.00]	[1.00]
	1.00	1.00	1.00	[0.33]	[1.00]	[1.00]
	1.00	1.00	--	[0.50]	[0.50]	--
	--	--	--	--	--	--

At this point we must suspect that either the autocorrelation which exists within the LANDSAT data does not significantly influence the classification procedure or that our testing method is not sufficiently sensitive to the effects of that autocorrelation. The sampling procedure followed, and evluation methods used, would seem to be sufficiently careful that any influence of autocorrelation which might exist could be expected to show up. Therefore we must tentatively conclude that autocorrelation will not significantly influence the accuracy of classification procedures when that influence is carefully examined. Because this is an important conclusion with respect to sampling techniques which might be used by other investigators, it is important to carefully document the extent of evidence available on this question and to thoroughly examine its importance as far as practical. Further tests of this idea then are described in the following section.

B. Phase II: Extension to Other Areas of the Denver Region

1. Sites Chosen

The results of the phase I analysis suggested that there may be measurable differences in the results and accuracy of evaluation which will be achieved as a function of the kind of sampling technique employed. Although the results suggest there are differences, those differences are not totally distinct, and are difficult to interpret. They do not appear to be of the sort which might be anticipated given autocorrelation structure in the data. Therefore in order to test the presence of this in general, further analysis is desirable. Results also suggest that the differences may show up more distinctly when the grids being analyzed are separated by a great distance. Therefore more samples are needed and the samples should be spread over a larger region.

Therefore it was decided to extend this analysis to other regions in the Denver area. A total of five quadrangles were chosen for further analysis. These are: Highlands Ranch, Littleton, Commerce City, East Lake, and the Sable quadrangles. The positions of each of these quadrangles are shown in figure 18. They were chosen because they display appoximately the same conditions of urban growth and expansion and transformation of land cover classes as was displayed in the original quadrangle chosen. Each of these areas is also contained with the same LANDSAT image which was used for the Fitzsimmons quadrangle and therefore it was possible to employ the same signatures developed in that quadrangle to classify the land cover within these areas. They also have the

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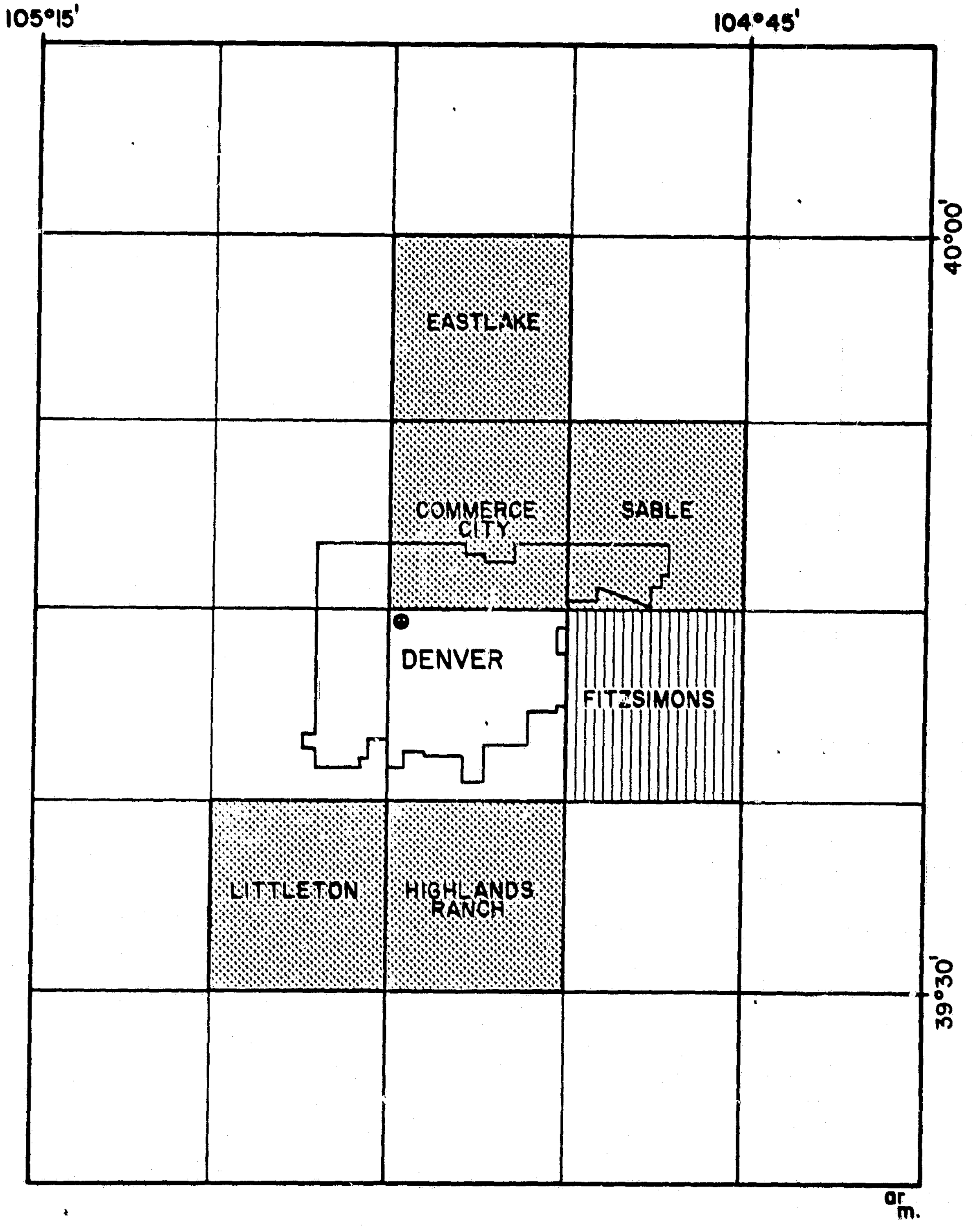


Figure 18. Locations of quadrangles chosen for the phase II analysis of the Denver area. The original quadrangle studied (Fitzsimmons) is shown for comparison.

advantage that aerial photography of the same time period is also available for these sites. Furthermore they all occur within the same physiographic region as was found for the Fitzsimmons quadrangle. Virtually identical land cover classes and characteristics occur within these quadrangles as was shown in the Fitzsimmons quadrangle. The same land cover classes were chosen for evaluation as previously. Within each of these quadrangles from three to nine one-square-mile grids were defined as done previously in the phase I study. The relative locations of each of these grids within the quadrangle chosen is shown in figures 19-22. The location of these grids was defined by the positioning of the land cover classes of interest within the quadrangle areas. U.S. Geological Survey $7\frac{1}{2}$' quadrangle maps are available for these areas and were used for location of areas during the study.

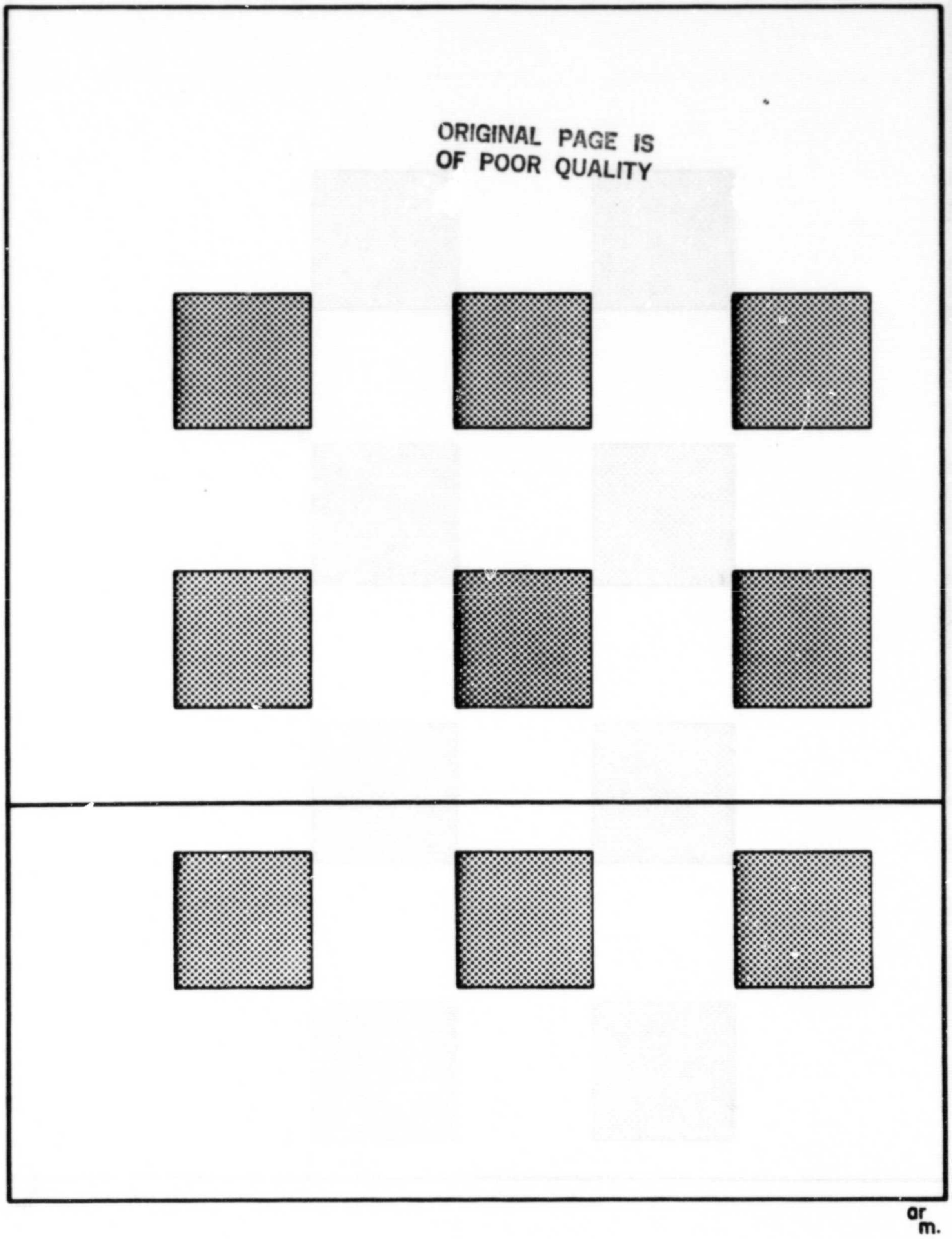


Figure 19. Location of grids chosen for study in the Commerce City (top) and East Lake (bottom) quadrangles, Colorado.

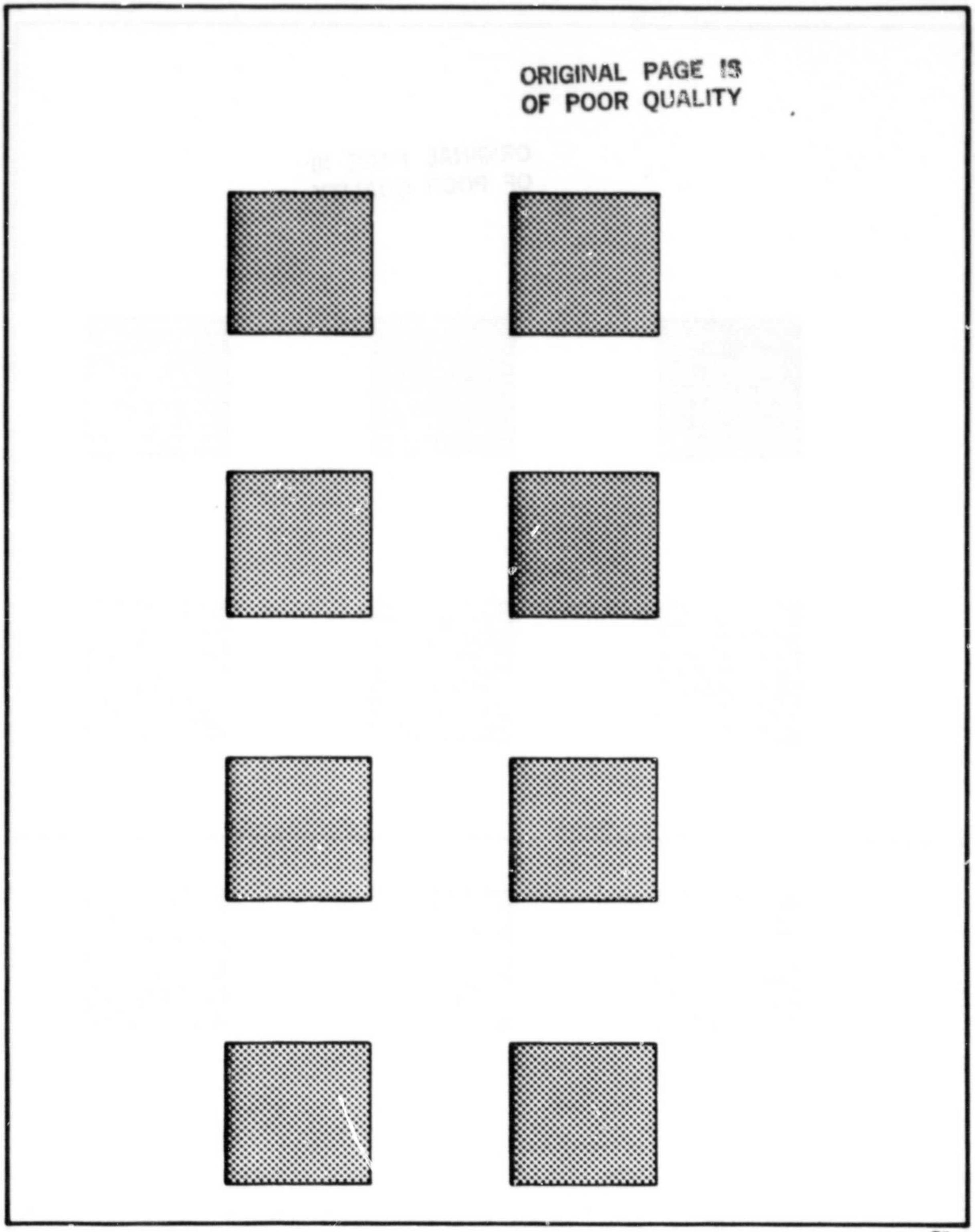


Figure 20. Location of grids chosen for study in the Sable, Colorado quadrangle.

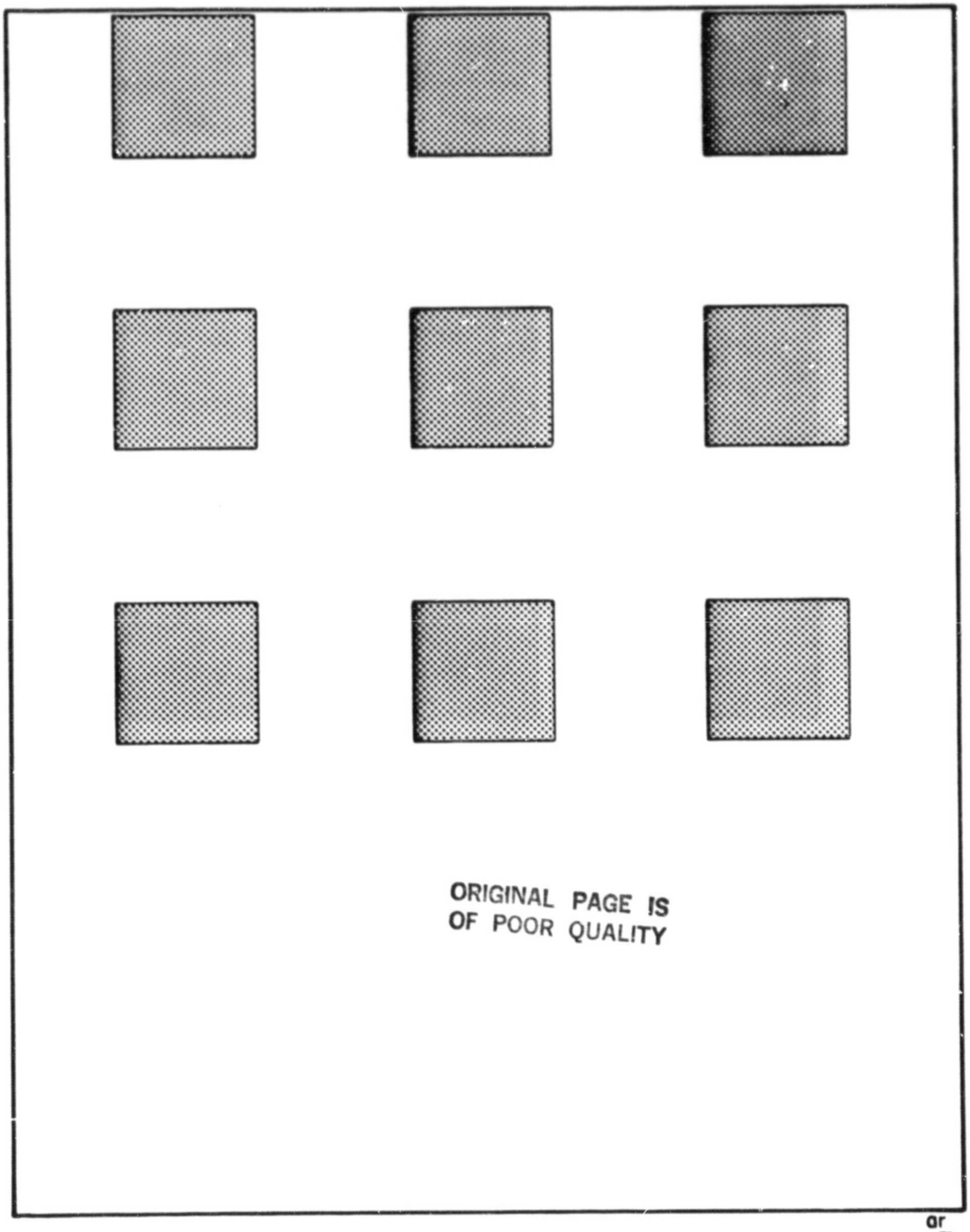
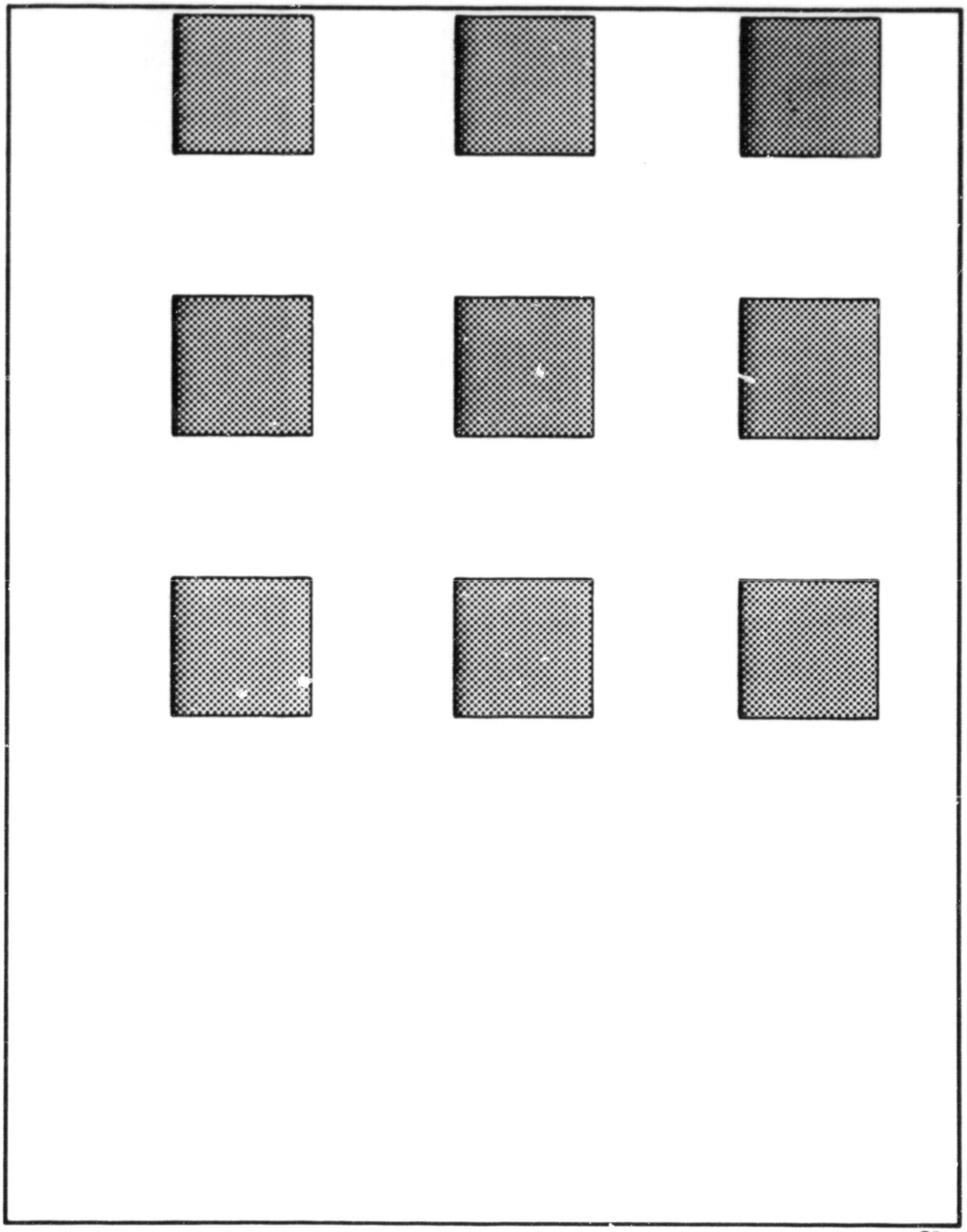


Figure 21. Location of grids chosen for study in the Littleton, Colorado quadrangle.



ar
m.

Figure 22. Location of grids chosen for study in the Highland Ranch, Colorado quadrangle.

2. Photo-interpreted Data

As in the phase I study the land cover classes were defined by and provided by the contract manager at NASA Goddard Space Flight Center. Classes were defined using a modified Anderson level II system as previously and the classes considered are listed in table 28. As can be seen, certain new classes not previously defined are included in this table. In addition several classes which had previously been considered in the phase I study are no longer included. These include classes that were considered only because they occurred within the Richmond study area in phase I. Furthermore certain class definitions have been slightly redefined for the phase II study. Comparison of tables 28 and 7 will show where these discrepancies occur.

Reproductions of the photo-interpreted overlays provided by NASA are given in Appendix C.2. The same procedure used in phase I was used to locate the exact positions of these overlays relative to 7½' topographic maps and relative to the LANDSAT data. The photo-interpreted data were digitized using the same procedure described in phase I and these data were input by the GRNDTH program and stored on disk for later analysis. Analysis included runs of BLKFND and DIFIND as done previously in the phase I study. The total number of pixels available for testing was determined with the DIFIND program. These numbers of pixels available in each quadrangle are listed in tables 29-32 and summarized in table 33. Appendix D.2 contains the data.

One of the important questions to be examined in phase II was the extent to which these signatures could be extrapolated to new areas in the same region as a function of the type sampling procedure which had been followed in developing the signatures originally. Therefore it was desirable to use the same classes in the accuracy evaluation as had been used in the

TABLE 28. Symbols used in the phase II analysis and the corresponding land cover classes they represent. Only defined classes represented by at least 10 pixels are listed.

Reported in photo interpretation grids	Used in internal machine representation	Land Cover Class
A	A	Agriculture
O	O	Other
U	U	Residential
C	C	Commercial
W	W	Water
B	B	Barren
R	R	Range
D	D	Disturbed
CN	#	Construction
UN	+	Residential with no or partial landscaping
Rip	$ or P	Riparian
UL	&	*
T	T	Transportation
L^- or U^-	^ or *	Low density residential
UH	%	Apartments or Townhouses

* This, and a number of other symbols were not defined in the photointerpreted data set supplied from NASA-GSFC. They include: UL, CX, DS, UM, OO, UH, U^-, LN and C^-. Because they are rare (see table 39) they are assumed to be minor errors of tabulation and were ignored in this analysis.

TABLE 29. Results of Program DIFIND. Number of pixels available for testing at a spacing of ten in the phase II grids of the Highland Ranch, Colorado, quadrangle.

Class	Grid Number 1	2	3	4	5	6	7	8	9	Total
A	1	6	--	--	--	--	--	--	--	7
R	--	3	5	--	--	--	9	9	6	32
U	--	--	--	6	5	6	--	--	4	21
O	4	2	2	--	2	--	--	--	1	11
C	--	1	3	3	1	2	--	--	--	10
D	--	--	2	--	1	2	--	1	--	6
Rip	--	2	--	--	--	--	--	--	--	2
W	--	--	--	--	--	--	--	--	--	0
B	--	--	1	--	--	--	--	--	1	2
L	5	--	--	--	--	--	--	--	--	5
UN	--	--	--	--	2	--	--	--	1	3
T	--	--	1	--	--	--	--	--	--	1
CN	--	--	1	--	1	--	--	--	--	2
										102

TABLE 30. Results of Program DIFIND. Number of pixels available for testing at a spacing of ten in the phase II grids of the East Lake, and Commerce City, Colorado, quadrangles.

GRID NUMBER

Class	East Lake						Commerce City			Total
	1	2	3	4	5	6	1	2	3	
A	7	7	5	--	1	--	--	3	8	31
R	--	1	6	--	4	--	--	4	--	15
U	1	--	--	5	1	--	7	--	--	14
O	1	3	1	--	1	8	--	2	--	16
C	--	--	--	--	--	--	3	--	1	4
D	--	--	--	3	1	--	--	--	--	4
Rip	--	--	--	--	--	1	--	2	--	3
W	1	--	--	--	--	1	--	--	--	2
B	--	2	--	--	1	--	1	--	--	4
$\bar{L}$	--	--	--	--	--	--	--	--	--	0
UN	--	--	--	--	2	--	--	--	--	2
T	--	--	--	--	--	--	--	--	1	1
CN	--	--	--	--	--	--	--	--	0	0
										96

TABLE 31. Results of Program DIFIND. Number of pixels available for testing at a spacing of ten in the phase II grids of the Littleton, Colorado quadrangle.

Class	Grid Number 1	2	3	4	5	6	7	8	9	Total
A	1	4	--	--	1	3	2	--	5	16
R	9	4	--	7	--	1	6	--	2	29
U	--	--	4	2	7	2	--	--	--	15
O	--	--	4	--	1	3	--	6	--	14
C	--	--	3	--	1	--	--	--	--	4
D	--	1	1	--	2	--	1	1	--	6
Rip	--	--	1	--	--	1	1	--	1	4
W	--	2	--	--	--	1	--	3	--	6
B	1	--	--	2	--	1	--	--	--	4
L^-	--	--	--	--	--	--	--	1	--	1
UN	--	--	--	2	--	--	--	--	--	2
T	--	--	--	--	--	--	--	--	--	0
CN	1	--	--	1	--	--	--	--	--	2
										103

TABLE 32. Results of Program DIFIND. Number of pixels available for testing at a spacing of ten in the phase II grids of the Sable, Colorado quadrangle.

	Grid Number								
Class	1	2	3	4	5	6	7	8	Total
A	--	--	--	--	--	5	--	4	9
R	8	9	5	9	--	5	3	2	41
U	--	--	1	--	7	--	3	--	11
O	3	--	2	1	1	1	2	4	14
C	1	--	3	--	--	--	2	--	6
D	--	--	--	--	--	--	1	--	1
Rip	--	2	--	--	--	--	--	1	3
W	--	--	--	--	--	--	--	--	0
B	--	--	--	--	--	--	--	--	0
L^-	--	--	--	--	--	--	--	--	0
UN	--	--	--	--	--	--	--	--	0
T	--	--	--	--	--	--	--	--	0
CN	--	--	--	--	--	--	--	--	0
									85

TABLE 33. Summary of pixels available for testing each land cover class in each of the quadrangles of the phase II study area.

Class	East Lake/ Commerce City	Littleton	Sable	Highland Ranch	Class Total	
A	31	16	9	7	63	
R	15	29	41	32	117	
U	14	15	11	21	61	
O	16	14	14	11	55	
C	4	4	6	10	24	
D	4	6	1	6	17	
Rip	3	4	3	2	12	
W	2	6	0	0	8	
B	4	4	0	2	10	
L^-	0	1	0	5	6	
UN	2	2	0	3	7	
T	1	0	0	1	2	
CN	0	2	0	2	4	
QUAD TOTALS	96	103	85	102	386	GRAND TOTAL

phase I study. Therefore the two original classes, residential and agriculture, were used. The remaining land cover classes were lumped in the single class other. All available land cover classes were determined for each quadrangle using the BLKFND program previously developed. These are listed for each grid of each quadrangle in tables 34-38. The data are summarized in table 39. The total number of pixels avaiable as determined by the program DIFIND were then further subset so that the number of pixels of each land cover class actually used in the accuracy evaluation would again be in proportion to their occurrence within the total photo-interpreted data set (table 40). Furthermore these pixels were split into two groups so that one half would be used in the blocked evaluation and one half used in the diffuse evaluation (table 41). The program TEST@ was run to determine exactly which pixels would be used in each test. The pixels chosen for each of the two tests for each land cover class are given in tables42 and 43.

TABLE 34. Number of pixels of the various land cover classes found in the Highland Ranch, Colorado quadrangle.

Class	Total	Grid 1	2	3	4	5	6	7	8	9
LN	22	22	--	--	--	--	--	--	--	--
L^-	311	311	--	--	--	--	--	--	--	--
O	373	168	36	51	26	36	5	--	14	37
A	302	40	262	--	--	--	--	--	--	--
C	374	5	10	200	110	24	22	--	--	3
Rip	107	--	81	11	--	--	10	--	--	5
R	1599	--	145	149	--	--	--	546	495	264
D	246	--	12	73	23	43	58	--	37	--
T	36	--	--	36	--	--	--	--	--	--
B	36	--	--	7	--	--	--	--	--	29
C^-	5	--	--	5	--	--	--	--	--	--
CN	70	--	--	14	--	47	--	--	--	9
U	1304	--	--	--	370	336	440	--	--	158
F	32	--	--	--	17	15	--	--	--	--
UN	86	--	--	--	--	45	--	--	--	41
U^+	11	--	--	--	--	--	11	--	--	--

TABLE 35. Number of pixels of the various land cover classes found in the Sable, Colorado quadrangle.

Class	Total	Grid 1	2	3	4	5	6	7	8
R	2090	378	546	185	517	--	252	174	38
O	528	131	--	128	8	20	24	74	143
C	255	37	--	134	--	12	--	59	13
D	39	--	--	8	--	8	--	23	--
Rip	77	--	--	41	21	--	--	6	9
U	697	--	--	50	--	471	--	176	--
CN	13	--	--	--	--	10	--	--	3
B	24	--	--	--	--	21	--	--	3
OO	1	--	--	--	--	1	--	--	--
U^+	3	--	--	--	--	3	--	--	--
A	545	--	--	--	--	--	270	--	275
T	77	--	--	--	--	--	--	34	43
U^-	19	--	--	--	--	--	--	--	19

TABLE 36. Number of pixels of the various land cover classes found in the East Lake, Colorado quadrangle.

Class	Total	Grid 1	2	3	4	5	6
A	1029	394	351	213	--	63	8
O	731	83	67	81	42	10	448
U	368	21	--	--	282	65	--
C	68	17	--	--	51	--	--
W	62	31	--	--	--	3	28
B	99	--	74	--	--	25	--
R	491	--	28	252	--	211	--
D	201	--	5	--	152	44	--
CN	19	--	--	--	19	--	--
UN	104	--	--	--	--	104	--
Rip	31	--	--	--	--	--	31
UL	31	--	--	--	--	--	31

TABLE 37. Number of pixels of the various land cover classes found in the Littleton, Colorado quadrangle.

Class	Total	Grid 1	2	3	4	5	6	7	8	9
R	1512	452	203	7	363	--	44	352	--	91
CN	51	36	--	--	15	--	--	--	--	--
B	137	30	--	--	72	--	35	--	--	--
O	731	17	29	181	--	18	103	10	347	26
A	879	11	234	--	--	25	160	135	--	314
W	278	--	57	7	--	--	38	--	170	6
D	190	--	23	42	9	52	--	41	23	--
C	172	--	--	139	--	32	10	--	--	--
U	691	--	--	130	54	419	82	--	--	--
Rip	194	--	--	43	--	--	41	7	--	103
UL	2	--	--	--	2	--	--	--	--	--
UN	40	--	--	--	31	--	9	--	--	--
T	39	--	--	--	--	--	24	--	--	15
DS	1	--	--	--	--	--	--	1	--	--
L^-	6	--	--	--	--	--	--	--	6	--
UM	4	--	--	--	--	--	--	--	--	4

TABLE 38. Number of pixels of the various land cover classes found in the Commerce City, Colorado quadrangle

Class	Total	Grid 1	2	3
B	34	34	--	--
U	426	426	--	--
C	98	86	--	12
A	663	--	156	507
R	175	--	175	--
O	73	--	61	12
Rip	133	--	133	--
T	14	--	--	14
CX	1	--	--	1

TABLE 39. Number of pixels of each landcover class present in each quadrangle of the phase II study area.

Class	East Lake	Commerce City	Littleton	Sable	Highlands Ranch	Grand Total
A	1029	663	879	545	302	3418
O	731	73	731	528	373	2436
U	368	426	691	697	1304	3486
C	68	98	172	255	374	967
W	62	--	278	--	--	340
B	99	34	137	24	36	330
R	491	175	1512	2090	1599	5867
D	201	--	190	39	246	676
CN	19	--	51	13	70	153
UN	104	--	40	--	86	230
Rip	31	133	194	77	107	542
UL	31	--	2	--	--	33
T	--	14	39	77	36	166
CX	--	1	--	--	--	1
DS	--	--	1	--	--	1
L^-	--	--	6	--	311	317
UM	--	--	4	--		4
OO	--	--	--	1	--	1
UH	--	--	--	3	11	14
$\bar{U}$	--	--	--	19	--	19
LN	--	--	--	--	22	22
C^-	--	--	--	--	5	5
P	--	--	--	--	32	32
						19060

TABLE 40. Computation of pixels desired in the phase II accuracy evaluation. This is based on the assumption that there were 61 pixels of "Residential" available to be used. Only symbols listed in table 28 and represented by at least 50 pixels in the total sample are considered.

Land cover class	Total pixels available	Percentage of all pixels available	Number of pixels desired in testing
R	5867	30.78	100.97
U	3486	18.29	60.00
A	3418	17.93	58.82
O	2436	12.78	41.93
C	967	5.07	16.63
D	676	3.55	11.65
Rip	542	2.84	9.32
W	340	1.78	5.84
B	330	1.73	5.68
L	317	1.66	5.45
UN	230	1.21	3.97
T	166	0.87	2.85
CN	153	0.80	2.62
	18928	99.29	325.73

TABLE 41. Computation of pixels to be used in the phase II accuracy evaluation.

Land Cover Class	Number of Pixels Desired	Number of Pixels Available at Spacing of 9	Number of Pixels To Be Used - Total/Per Test	Proportion of* Total in Same Class	Proportion of* Available in Same Class	Percentage of Pixels Used
R	100.97	117	100/50	0.0085	0.427	30.86
U	60.00	61	60/30	0.0086	0.492	18.52
A	58.82	63	58/29	0.0085	0.460	17.90
O	41.93	55	42/21	0.0086	0.382	12.96
C	16.63	24	16/8	0.0083	0.333	4.94
D	11.65	17	12/6	0.0089	0.353	3.70
Rip	9.32	12	10/5	0.0092	0.417	3.09
W	5.84	8	6/3	0.0088	0.375	1.85
B	5.68	10	6/3	0.0091	0.300	1.85
L^-	5.45	6	6/3	0.0095	0.500	1.85
UN	3.97	7	4/2	0.0087	0.286	1.23
T	2.85	2	2/1	0.0060	0.500	0.62
CN	2.62	4	2/1	0.0065	0.250	0.62
	271.36	386	324/162			

* These are the proportions of each test set relative to the listed class total.

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TABLE 42. Coordinates of pixels chosen for the accuracy evaluation of the Blocked sampling technique, phase II analysis. Symbols correspond to land cover classes listed in table 28.

COUNT	SYMBOL	SCAN LINE	ELEMENT	GRID	QUADRANGLE
1	^	2	4	1	HIGHLAND RANCH
2	^	2	15	1	HIGHLAND RANCH
1	O	4	25	1	HIGHLAND RANCH
3	^	11	9	1	HIGHLAND RANCH
2	O	19	2	1	HIGHLAND RANCH
1	$	2	2	2	HIGHLAND RANCH
3	O	2	14	2	HIGHLAND RANCH
1	C	2	24	2	HIGHLAND RANCH
1	R	10	19	2	HIGHLAND RANCH
1	A	11	6	2	HIGHLAND RANCH
2	A	19	12	2	HIGHLAND RANCH
3	A	20	21	2	HIGHLAND RANCH
2	C	2	9	3	HIGHLAND RANCH
2	R	2	21	3	HIGHLAND RANCH
4	O	9	2	3	HIGHLAND RANCH
1	D	10	14	3	HIGHLAND RANCH
3	R	12	25	3	HIGHLAND RANCH
4	R	18	3	3	HIGHLAND RANCH
3	C	19	19	3	HIGHLAND RANCH
1	U	2	4	4	HIGHLAND RANCH
2	U	2	15	4	HIGHLAND RANCH
4	C	2	25	4	HIGHLAND RANCH
3	U	11	5	4	HIGHLAND RANCH
4	U	11	16	4	HIGHLAND RANCH
5	C	14	25	4	HIGHLAND RANCH
5	U	20	3	4	HIGHLAND RANCH
6	U	20	15	4	HIGHLAND RANCH
7	U	2	3	5	HIGHLAND RANCH
2	D	2	23	5	HIGHLAND RANCH
8	U	3	12	5	HIGHLAND RANCH
9	U	10	18	5	HIGHLAND RANCH
10	U	11	4	5	HIGHLAND RANCH
11	U	17	12	5	HIGHLAND RANCH
3	D	2	7	6	HIGHLAND RANCH
12	U	2	20	6	HIGHLAND RANCH
13	U	9	13	6	HIGHLAND RANCH
14	U	10	2	6	HIGHLAND RANCH
15	U	11	22	6	HIGHLAND RANCH
16	U	17	8	6	HIGHLAND RANCH
17	U	20	17	6	HIGHLAND RANCH
5	R	2	4	7	HIGHLAND RANCH
6	R	2	15	7	HIGHLAND RANCH
7	R	2	25	7	HIGHLAND RANCH
8	R	10	10	7	HIGHLAND RANCH
9	R	10	20	7	HIGHLAND RANCH
10	R	16	3	7	HIGHLAND RANCH
11	R	19	15	7	HIGHLAND RANCH
12	R	20	24	7	HIGHLAND RANCH
4	D	2	5	8	HIGHLAND RANCH
13	R	2	17	8	HIGHLAND RANCH
14	R	8	24	8	HIGHLAND RANCH
15	R	10	12	8	HIGHLAND RANCH
16	R	11	2	8	HIGHLAND RANCH
17	R	16	19	8	HIGHLAND RANCH
18	R	19	7	8	HIGHLAND RANCH
19	F	2	2	9	HIGHLAND RANCH
20	F	2	15	9	HIGHLAND RANCH

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Table 42 (continued)

21	R	3	24	9	HIGHLAND RANCH
18	U	9	9	9	HIGHLAND RANCH
19	U	12	18	9	HIGHLAND RANCH
20	U	18	8	9	HIGHLAND RANCH
22	R	20	24	9	HIGHLAND RANCH
23	R	2	2	1	SABLE
5	O	2	17	1	SABLE
24	R	8	10	1	SABLE
25	R	8	24	1	SABLE
26	R	14	2	1	SABLE
6	C	15	16	1	SABLE
27	R	17	25	1	SABLE
28	R	2	2	2	SABLE
29	R	2	14	2	SABLE
30	R	2	25	2	SABLE
31	R	10	7	2	SABLE
32	R	10	19	2	SABLE
33	R	17	13	2	SABLE
34	R	18	25	2	SABLE
35	R	19	2	2	SABLE
7	C	2	4	3	SABLE
8	C	2	14	3	SABLE
36	R	5	25	3	SABLE
37	R	11	9	3	SABLE
6	O	13	16	3	SABLE
21	U	19	4	3	SABLE
38	R	2	7	4	SABLE
39	R	2	19	4	SABLE
40	R	10	13	4	SABLE
41	R	11	2	4	SABLE
42	R	11	22	4	SABLE
43	R	18	8	4	SABLE
44	R	19	17	4	SABLE
22	U	2	2	5	SABLE
23	U	2	12	5	SABLE
24	U	2	22	5	SABLE
25	U	11	8	5	SABLE
26	U	11	20	5	SABLE
27	U	18	14	5	SABLE
1	B	19	25	5	SABLE
28	U	20	5	5	SABLE
4	A	2	2	6	SABLE
5	A	2	16	6	SABLE
7	O	3	25	6	SABLE
6	A	8	9	6	SABLE
7	A	11	18	6	SABLE
45	R	14	2	6	SABLE
46	R	18	11	6	SABLE
47	R	19	23	6	SABLE
48	R	5	6	7	SABLE
49	R	6	15	7	SABLE
5	D	10	24	7	SABLE
29	U	14	9	7	SABLE
30	U	17	18	7	SABLE
8	O	20	2	7	SABLE
9	O	2	2	8	SABLE
50	F	2	21	8	SABLE
8	A	8	9	8	SABLE
9	A	11	20	8	SABLE

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10	O	17	4	8	SABLE
10	A	19	25	8	SABLE
11	A	2	6	1	EAST LAKE
12	A	2	16	1	EAST LAKE
13	A	4	25	1	EAST LAKE
14	A	11	9	1	EAST LAKE
11	O	12	20	1	EAST LAKE
15	A	20	2	1	EAST LAKE
16	A	20	12	1	EAST LAKE
17	A	2	2	2	EAST LAKE
18	A	2	12	2	EAST LAKE
12	O	5	24	2	EAST LAKE
19	A	11	4	2	EAST LAKE
20	A	11	14	2	EAST LAKE
21	A	15	23	2	EAST LAKE
2	B	20	10	2	EAST LAKE
13	O	5	2	3	EAST LAKE
22	A	11	25	3	EAST LAKE
23	A	13	10	3	EAST LAKE
24	A	18	2	3	EAST LAKE
25	A	19	20	3	EAST LAKE
6	D	3	22	4	EAST LAKE
1	+	2	9	5	EAST LAKE
3	B	2	20	5	EAST LAKE
2	+	10	15	5	EAST LAKE
26	A	13	24	5	EAST LAKE
14	O	2	5	6	EAST LAKE
15	O	2	15	6	EAST LAKE
16	O	2	25	6	EAST LAKE
17	O	11	12	6	EAST LAKE
18	O	12	22	6	EAST LAKE
19	O	16	3	6	EAST LAKE
20	O	8	10	1	LITTLETON
1	W	2	4	2	LITTLETON
21	O	6	22	2	LITTLETON
27	A	12	15	2	LITTLETON
28	A	15	2	2	LITTLETON
29	A	17	23	2	LITTLETON
2	$	13	19	3	LITTLETON
3	$	6	10	6	LITTLETON
2	W	13	2	6	LITTLETON
3	W	15	16	8	LITTLETON
1	T	3	2	9	LITTLETON
4	$	20	16	9	LITTLETON
5	$	8	21	2	COMMERCE CITY

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TABLE 43. **Coordinates of pixels chosen for the accuracy evaluation of Diffuse sampling technique, phase II analysis. Symbols correspond to land cover classes listed in table 28.**

COUNT	SYMBOL	SCAN LINE	ELEMENT	GRID	QUADRANGLE
1	^	2	4	1	HIGHLAND RANCH
2	^	2	14	1	HIGHLAND RANCH
1	O	5	25	1	HIGHLAND RANCH
3	^	11	10	1	HIGHLAND RANCH
2	O	16	2	1	HIGHLAND RANCH
3	O	20	12	1	HIGHLAND RANCH
1	$	2	3	2	HIGHLAND RANCH
1	R	2	18	2	HIGHLAND RANCH
2	R	9	24	2	HIGHLAND RANCH
1	A	11	2	2	HIGHLAND RANCH
2	A	12	13	2	HIGHLAND RANCH
3	A	19	20	2	HIGHLAND RANCH
4	A	20	5	2	HIGHLAND RANCH
1	C	2	7	3	HIGHLAND RANCH
3	R	2	23	3	HIGHLAND RANCH
1	D	8	14	3	HIGHLAND RANCH
4	O	11	2	3	HIGHLAND RANCH
4	R	11	25	3	HIGHLAND RANCH
2	D	17	18	3	HIGHLAND RANCH
2	C	18	9	3	HIGHLAND RANCH
1	U	2	4	4	HIGHLAND RANCH
2	U	2	16	4	HIGHLAND RANCH
3	C	3	25	4	HIGHLAND RANCH
3	U	11	2	4	HIGHLAND RANCH
4	U	11	17	4	HIGHLAND RANCH
3	D	17	24	4	HIGHLAND RANCH
4	D	18	9	4	HIGHLAND RANCH
5	U	2	2	5	HIGHLAND RANCH
6	U	2	12	5	HIGHLAND RANCH
5	D	2	24	5	HIGHLAND RANCH
7	U	10	18	5	HIGHLAND RANCH
8	U	11	4	5	HIGHLAND RANCH
9	U	18	13	5	HIGHLAND RANCH
5	O	20	2	5	HIGHLAND RANCH
6	D	2	7	6	HIGHLAND RANCH
10	U	2	18	6	HIGHLAND RANCH
11	U	10	2	6	HIGHLAND RANCH
12	U	10	24	6	HIGHLAND RANCH
13	U	11	12	6	HIGHLAND RANCH
14	U	18	18	6	HIGHLAND RANCH
15	U	19	3	6	HIGHLAND RANCH
5	R	2	3	7	HIGHLAND RANCH
6	R	2	13	7	HIGHLAND RANCH
7	R	2	23	7	HIGHLAND RANCH
8	R	10	8	7	HIGHLAND RANCH
9	R	11	18	7	HIGHLAND RANCH
10	R	17	2	7	HIGHLAND RANCH
11	R	17	25	7	HIGHLAND RANCH
12	R	20	11	7	HIGHLAND RANCH
13	R	2	14	8	HIGHLAND RANCH
14	R	2	24	8	HIGHLAND RANCH
15	R	4	5	8	HIGHLAND RANCH
16	R	11	11	8	HIGHLAND RANCH

17	R	11	22	8	HIGHLAND RANCH
18	R	16	2	8	HIGHLAND RANCH
19	R	20	13	8	HIGHLAND RANCH
20	R	20	23	8	HIGHLAND RANCH
21	R	2	4	9	HIGHLAND RANCH
22	R	2	17	9	HIGHLAND RANCH
23	R	8	25	9	HIGHLAND RANCH
16	U	10	10	9	HIGHLAND RANCH
6	O	17	23	9	HIGHLAND RANCH
1	+	19	13	9	HIGHLAND RANCH
1	B	20	3	9	HIGHLAND RANCH
24	R	2	4	1	SABLE
25	R	2	14	1	SABLE
26	R	2	25	1	SABLE
27	R	11	8	1	SABLE
7	O	11	20	1	SABLE
28	R	19	3	1	SABLE
29	R	20	25	1	SABLE
30	R	2	2	2	SABLE
31	R	2	15	2	SABLE
32	R	3	25	2	SABLE
33	R	9	9	2	SABLE
34	R	11	20	2	SABLE
35	R	16	2	2	SABLE
36	R	18	12	2	SABLE
37	R	20	22	2	SABLE
4	C	2	2	3	SABLE
5	C	2	12	3	SABLE
38	R	5	25	3	SABLE
39	R	11	9	3	SABLE
8	O	12	19	3	SABLE
17	U	19	4	3	SABLE
40	R	2	3	4	SABLE
41	R	2	13	4	SABLE
42	R	2	23	4	SABLE
43	R	10	18	4	SABLE
44	R	11	2	4	SABLE
45	R	16	10	4	SABLE
46	R	16	25	4	SABLE
18	U	2	2	5	SABLE
19	U	2	14	5	SABLE
20	U	3	23	5	SABLE
6	C	9	8	5	SABLE
21	U	12	17	5	SABLE
22	U	18	7	5	SABLE
2	B	19	25	5	SABLE
5	A	2	3	6	SABLE
47	R	2	13	6	SABLE
9	O	2	24	6	SABLE
6	A	10	8	6	SABLE
7	A	10	18	6	SABLE
48	R	18	2	6	SABLE
49	R	19	12	6	SABLE
50	R	19	24	6	SABLE
7	C	2	8	7	SABLE
8	C	2	18	7	SABLE
23	U	10	13	7	SABLE
24	U	12	4	7	SABLE
25	U	13	22	7	SABLE

TABLE 43 (continued)

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10	O	19	15	7	SABLE
11	O	2	2	8	SABLE
12	O	2	12	8	SABLE
8	A	6	21	8	SABLE
13	O	11	3	8	SABLE
9	A	12	12	8	SABLE
10	A	15	22	8	SABLE
11	A	2	2	1	EAST LAKE
12	A	2	24	1	EAST LAKE
13	A	6	15	1	EAST LAKE
14	A	12	5	1	EAST LAKE
14	O	12	22	1	EAST LAKE
15	A	18	12	1	EAST LAKE
16	A	2	2	2	EAST LAKE
17	A	2	12	2	EAST LAKE
18	A	3	21	2	EAST LAKE
19	A	10	7	2	EAST LAKE
20	A	12	16	2	EAST LAKE
21	A	17	24	2	EAST LAKE
3	B	19	8	2	EAST LAKE
15	O	5	5	3	EAST LAKE
16	O	10	23	3	EAST LAKE
22	A	14	3	3	EAST LAKE
23	A	19	18	3	EAST LAKE
26	U	2	3	4	EAST LAKE
27	U	4	13	4	EAST LAKE
28	U	11	5	4	EAST LAKE
29	U	13	14	4	EAST LAKE
30	U	20	4	4	EAST LAKE
2	+	2	9	5	EAST LAKE
24	A	13	24	5	EAST LAKE
17	O	2	5	6	EAST LAKE
18	O	2	18	6	EAST LAKE
19	O	8	25	6	EAST LAKE
20	O	9	11	6	EAST LAKE
21	O	11	2	6	EAST LAKE
25	A	19	25	1	LITTLETON
1	W	2	4	2	LITTLETON
2	W	7	25	2	LITTLETON
26	A	10	16	2	LITTLETON
27	A	15	4	2	LITTLETON
28	A	16	24	2	LITTLETON
2	$	13	19	3	LITTLETON
29	A	3	18	5	LITTLETON
3	$	6	10	6	LITTLETON
3	W	11	2	6	LITTLETON
1	T	3	2	9	LITTLETON
4	$	7	19	9	LITTLETON
5	$	8	21	2	COMMERCE CITY

3. PPD Classifier Results

As indicated it was desired to employ the same signatures to classify the land cover within the new phase II area as had originally been developed for the phase I study of the Fitzsimmons quadrangle. The exact coordinates of the grids to be classified by PPD were chosen using the same overlay correspondence and $7\frac{1}{2}'$ quadrangle registration procedures as described in the phase I study. It was apparent that registration was quite accurate in the phase II evaluation as it was quite possible to ensure correspondence exceeding plus or minus one-half pixel since the land cover classes were so distinctive in these areas. Once the coordinates of each grid were chosen (see tables 44-47), these grids were individually classified using PPD and the same signatures listed in table 16 and 17. The classified imagery was output to disk file on the Burroughs and thence transferred to disk file on the HP for accuracy evaluation. The results of the classification procedure are presented in Appendix F.2 .

TABLE 44. Coordinates of grids used in the Phase II Analysis of the Highlands Ranch quadrangle. *

Grid Number	Beginning Scan Line	Enging Scan Line	Beginning Element	Ending Element	Number of Scan lines	Number of Elements
1	2276	2296	1891	2006	21	26
2	2276	2296	2034	2059	21	26
3	2276	2296	2086	2111	21	26
4	2318	2338	1981	2006	21	26
5	2318	2338	2034	1059	21	26
6	2318	2338	2086	2111	21	26
7	2360	2382	1981	2006	21	26
8	2360	2382	2034	2059	21	26
9	2360	2382	2086	2111	21	26

*Note that these coordinates are transformed from the original scan line and element numbers due to rotation, scaling and geometric corrections used in the ORSER program SUBGM.

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TABLE 45. Coordinates of grids used in the Phase II Analysis of the Littleton, Colorado quadrangle. *

Grid Number	Beginning Scan Line	Ending Scan Line	Beginning Element	Ending Element	Number of Scan lines	Number of Elements
1	2276	2296	1798	1823	21	26
2	2276	2296	1851	1876	21	26
3	2276	2296	1903	1928	21	26
4	2318	2338	1798	1823	21	26
5	2318	2338	1850	1875	21	26
6	2318	2338	1903	1928	21	26
7	2360	2381	1797	1822	21	26
8	2360	2380	1849	1874	21	26
9	2360	2380	1901	1926	21	26

*Note that these coordinates are transformed from the original scan line and element numbers due to rotation, scaling and geometric corrections used in the ORSER program SUBGM.

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TABLE 46. Coordinates of grids used in the Phase II Analysis of the Sable, Colorado quadrangle. *

Grid Number	Beginning Scan Line	Ending Scan Line	Beginning Element	Ending Element	Number of Scan lines	Elements
1	1937	1957	2162	2187	21	26
2	1937	1957	2214	2239	21	26
3	1978	1998	2162	2187	21	26
4	1978	1998	2214	2239	21	26
5	2020	2040	2162	2187	21	26
6	2020	2040	2214	2239	21	26
7	2062	2082	2162	2187	21	26
8	2062	2082	2214	2239	21	26

*Note that these coordinates are transformed from the original scan line and element numbers due to rotation, scaling and geometric corrections used in the ORSER program SUBGM.

TABLE 47. Coordinates of grids used in the Phase II Analysis of East Lake (1-6) and Commerce City (7-9), Colorado *

Grid Number	Beginning Scan Line	Ending Scan Line	Beginning Element	Ending Element	Number of Scan lines	Number of Elements
1	1791	1811	2017	2042	21	26
2	1791	1811	2069	2093	21	25
3	1791	1811	2121	2146	21	26
4	1833	1853	2017	2042	21	26
5	1833	1853	2069	2093	21	25
6	1833	1853	2121	2146	21	26
7	1875	1895	2017	2042	21	26
8	1875	1895	2069	2093	21	25
9	1875	1895	2121	2146	21	26

*Note that these coordinates are transformed from the original scan line and element numbers due to rotation, scaling and geometric corrections used in the ORSER program SUBGM.

4. Accuracy Evaluation and Testing

Using the coordinates produced by the TEST@ program accuracy of the BLOCKED and DIFFUSE techniques were evaluated for the phase II study area. The coordinates of pixels to be tested had been determined through the use of the TEST@ program under the criteria discussed in section 3 above. The program ABSTAT was run on each grid of the phase II area to measure the correspondence between the photo-interpreted land cover ground truth and the PPD classified LANDSAT data. For each grid of each quadrangle a confusion table was produced as previously in the phase I study. A summary of these classification accuracy values is presented in table 48. In addition to the individual confusion tables presented for each grid in Appendix G.2 a cumulative confusion table (table 49) was also calculated. Examination of this table shows that there is an overall slight improvement in 'overall classification accuracy' when the DIFFUSE technique is used rather than the BLOCKED technique. As can be seen by examination of table 30 the overall classification accuracy values tend to be much lower for the quadrangls in the phase II study than they were for the quadrangles in the phase I study. This is not surprising since the signatures used in classification were developed within the quadrangles of the phase I study so that it can be anticipated they are more representative of the characteristics of the land cover classes directly within those areas. As in the phase I study the mean and standard deviation for each quadrangle was computed individually and these values are reported in table 50. Examination of this table shows no clear tendencies for either technique to be superior to the other in terms of the mean overall classification accuracy. In two of the quadrangles studied the BLOCKED technique yields improved mean overall classification

TABLE 48. Overall classification accuracy achieved in each grid of the phase II quadrangles for each of the two techniques.

Quadrangle	Grid	Overall classification accuracy BLOCKED	DIFFUSE
Highland Ranch	1	0.80	0.67
	2	0.57	0.29
	3	0.86	0.86
	4	0.25	1.00
	5	0.17	0.43
	6	0.29	0.71
	7	0.38	0.50
	8	0.86	0.50
	9	0.71	0.57
Sable	1	0.57	0.57
	2	0.63	0.50
	3	0.67	0.83
	4	1.00	0.86
	5	0.13	--
	6	0.25	0.63
	7	0.83	0.83
	8	0.50	0.17
East Lake	1	0.14	0.17
	2	0.57	0.29
	3	0.00	0.50
	4	0.00	0.20
	5	0.25	0.00
	6	0.83	0.40
Littleton	1	1.00	0.00
	2	0.40	0.40
	3	1.00	1.00
	4	--	--
	5	--	0.00
	6	1.00	0.50
	7	--	--
	8	1.00	--
	9	0.50	0.50

TABLE 49. Cumulative confusion tables and measures of accuracy achieved with the (A) BLOCKED and (B) DIFFUSE techniques in the phase II study.

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TEST TYPE: BLOCK COORDINATE

(A)

CUMULATIVE CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	3	2	24	29	26	.90	.06
U	AGRICULTURE (A)	0	6	24	30	24	.80	.15
E	OTHER (O)	18	9	74	101	27	.27	.50
TOTALS		21	17	122	160	77		
COMMISSIONS		18	11	48	77			
		.86	.65	.39				

OVERALL CLASSIFICATION ACCURACY .52 P(ALPHA ERROR)= .63

OVERALL MAPPING ACCURACY .40 P(BETA ERROR) = .65

****

TEST TYPE: DIFFUSE COORDINATE

(B)

CUMULATIVE CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	1	9	19	29	28	.97	.03
U	AGRICULTURE (A)	0	15	10	25	10	.40	.27
E	OTHER (O)	11	22	66	99	33	.33	.52
TOTALS		12	46	95	153	71		
COMMISSIONS		11	31	29	71			
		.92	.67	.31				

OVERALL CLASSIFICATION ACCURACY .54 P(ALPHA ERROR)= .63

OVERALL MAPPING ACCURACY .40 P(BETA ERROR) = .57

****

TABLE 50. Summary of overall classification accuracy measures for each quadrangle of the phase II study.

	N's		Means		Standard Deviations	
Data Set	B	D	B	D	B	D
Highland Ranch	9	9	0.54	0.61	0.28	0.22
Sable	8	7	0.57	0.63	0.29	0.25
East Lake	6	6	0.30	0.26	0.34	0.18
Littleton	6	6	0.82	0.40	0.29	0.37
All grids	29	28	0.56	0.50	0.33	0.29
OVERAL REGION	1	1	0.52	0.54	--	--

accuracies over that of the DIFFUSE technique. In the other two quadrangles the DIFFUSE technique appears to be superior. A more comprehensive examination of the relative performance of the two techniques can be obtained by computation of the mean and standard deviation of all the grids for all quadrangles combined. This value is also reported in table 50. As can be seen the mean value indicates a very slight improvement of accuracy using the DIFFUSE technique over that achieved by the BLOCKED technique. In table 50 is also the value of overall classification accuracy computed using the combined confusion table from all of the grids within all of the quadrangles studied. Although this value gives a good measure of the relative accuracy achieved by each technique, there is no measure of variance available for this value, and therefore it is not possible to test for significance of the differences observed. It appears that the best value available for testing the relative quality of the two techniques is that of the mean of all of the grids combined. The two values for BLOCKED and DIFFUSE were compared using a two sample t-test using the variances for each of the two techniques reported in table 50. The t-value computed is 0.75 and there is no indication that the Null Hypothesis that there is no significant difference in the two means should be rejected. Apparently both techniques yield equivalent accuracy when applied to these areas.

This is not the end of the examination, however; another interesting feature exists in these data. Examination of table 31 indicates that the BLOCKED technique consistently yields higher values of standard deviation than the DIFFUSE technique. This was also observed in the phase I study (table 26). Thus there is an important question of whether the BLOCKED technique does in fact yield significantly higher degrees of variability in classifier accuracy than does the DIFFUSE technique. This question was examined

by computation of F-statistic given by the ratio of the two variances, with the BLOCKED variance as the numerator. The computed value of F is 1.295 and this value is significant at the 75% confidence level, the level previously determined to be desired in this study. Thus it is reasonable to reject the Null Hypothesis that both techniques yield homogeneous variance in overall classification accuracy, in favor of the alternative that the BLOCKED techniques yield variances in overall classification accuracy greater than the DIFFUSE technique does. Thus we conclude that mean classification accuracy is the same in both techniques but the uncertainty in our evaluation of that accuracy will be greater when using the BLOCKED technique. This would appear to indicate that the BLOCKED technique yields less consistent results than does the DIFFUSE technique. An explanation for this observation will be suggested in the following section.

V. INTERPRETATIONS AND CONCLUSIONS

It has been shown that autocorrelation in the LANDSAT data is present in both areas which were studied, Richmond and Denver. Moreover the degree of autocorrelation is different in both areas. In both the phase I and the phase II studies it has been shown that classifier accuracy is affected by a sampling scheme directed to removing the autocorrelation measured in the LANDSAT images. It is reasonable to conclude from these facts that the autocorrelation affects classifier accuracy. The parameter of classifier accuracy which is affected by the autocorrelation is not the mean overall classifier accuracy, rather it is the variance in that accuracy. It was shown that using autocorrelated data to develop signatures for the use of digitial classifiers results in less consistent classification than can be achieved if non-autocorrelated data are used. In some instances, the autocorrelated data will in fact yield better results than non-autocorrelated data. However, in others the autocorrelated data yield results considerably worse.

These observations make sense if the autocorrelation arises from characteristics of the terrain being sensed. In particular, it is suggested that it is the degree of relation between adjacent slopes which create that autocorrelation by their influence on reflected light intensity received by the satellite. If it is the case that sometimes the pixels used for developing a signature are on the same terrain type as the pixels being classified the results of classification can be expected to be of high quality. Unfortunately equally frequently or perhaps more so, the terrain underlying the pixels to be classified may have different properties than the terrian underlying the pixels from which the signatures were developed; and so the results will be poor. The use of non-autocorrelated pixels

to develop signatures for classification can be expected to yield more consistent results since they have been taken so as to include a measure of the variability that terrain can induce in reflectance properties.

The actual effect being induced by the terrain could be as simple as the direction in which the slope faces. It is well known that reflectance is influenced strongly by slope azimuth and inclination so that if pixels are taken from a slope facing one direction to develop the signatures they may not yield good classifications for pixels on a slope facing another direction. If this is so, then the autocorrelation measured simply gives information on how to sample pixels "randomly" with respect to slope direction or, influencing slope characteristics, whatever they may be. The suggestion is strong that development of signatures ought not to be done independently of the characteristics of the terrain upon which those land cover classes set. A significant improvement in classifier results may be obtained with a technique as simple as development of a signature for each land cover class over each principal slope condition upon which that land cover class can be found within the region of interest. It would be quite reasonable then to examine the question of whether development of signatures under conditions in which the terrain characteristics are carefully screened and adjusted for could result in improved classifier accuracy. This researcher recommends that such a technique be attempted.

VI. ACKNOWLEDGEMENTS

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The considerable assistance of Mr. David Toll, NASA GSFC, is acknolwedged. Dave provided the initial impetus to begin this study. He also supplied the photo-interpreted data required for the analysis. His help is also acknowledged in insuring that the work was finally completed; and his patience in waiting for the results is warmly appreciated. At KSU, Carol Toncar was very helpful in initiating and monotoring the grant budget. Dr. Richard Heimlich, Chairperson of the Department of Geology, is acknowledge for his help in successfully completing this project. He kindly allowed the author time off from some teaching responsibilities so that the work could be completed. This project was funded as NASA Contract NAS 5-26111.

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APPENDICES

Appendix A

Computer Programs Used in the Study

This Appendix includes only programs written specifically for this analysis. They were developed under contract to NASA and as such are the property of the U.S. Government. The following programs are included:

GRNDTH

```
10    ! RE-STORE "GRNDTH"
20    ! ********************************************************************
30    ! ********************************************************************
40    ! ************************ G R N D T H *******************************
50    ! ********************************************************************
60    ! ********************************************************************
70    ! *                                                                  *
80    ! *      THIS PROGRAM IS USED TO INPUT THE DIGITIZED GROUND TRUTH DATA *
90    ! *      FOR EACH GRID OF THE STUDY AREA. THESE DATA ARE THEN OUTPUT   *
100   ! *      TO A DISK FILE FOR STORAGE.                                 *
110   ! *                                                                  *
120   ! *      WRITTEN UNDER NASA CONTRACT NAS5-26111 BY:                  *
130   ! *                                                                  *
140   ! *                       RICHARD G. CRAIG                           *
150   ! *                    DEPARTMENT OF GEOLOGY                         *
160   ! *                    KENT STATE UNIVERSITY                         *
170   ! *                      KENT, OHIO 44242                            *
180   ! *                                                                  *
190   ! ********************************************************************
200   OPTION BASE 1
210   DIM Land_cover$(21,26)[2],Region$[1]
220   No_scan_lines=21
230   No_elements=26
240   INPUT "WHAT REGION? (D=DENVER, R=RICHMOND)",Region$
250   IF Region$="R" THEN No_scan_lines=13
260   IF Region$="R" THEN No_elements=16
270   REDIM Land_cover$(No_scan_lines,No_elements)
280   Quad$=""
290   IF Region$="R" THEN INPUT "WHICH QUAD? (S=SEVEN PINES, C=CHESTERFIELD)",Qu
ad$
300   INPUT "WHAT GRID NUMBER?",Grid_number
310   Answer$="N"
320   INPUT "WOULD YOU LIKE TO VIEW AN EXISTING FILE? (Y/N)",Answer$
330   IF Answer$="Y" THEN 410
340   FOR Scan_line=1 TO No_scan_lines
350     FOR Element=1 TO No_elements
360       INPUT Land_cover$(Scan_line,Element)
370       PRINT USING "#,A";Land_cover$(Scan_line,Element)
380     NEXT Element
390     PRINT
400   NEXT Scan_line
410   IF Answer$="Y" THEN ASSIGN #1 TO Region$&Quad$&VAL$(Grid_number)&":F8",Ret
urn_variable
420   IF (Answer$="Y") AND (Return_variable<>0) THEN PRINT "FILE NOT FOUND"
430   IF (Answer$="Y") AND (Return_variable<>0) THEN 240
440   IF Answer$="Y" THEN MAT READ #1;Land_cover$
450   Answer$="N"
460   IF Answer$="Y" THEN INPUT "WHAT SCAN LINE?",Scan_line
470   IF Answer$="Y" THEN INPUT "WHAT ELEMENT?",Element
480   IF Answer$="Y" THEN EDIT "GIVE NEW VALUE",Land_cover$(Scan_line,Element)
490   Answer$="N"
500   CALL Print_out(Land_cover$(*),No_scan_lines,No_elements,16)
510   INPUT "ANY ERRORS? (Y/N)",Answer$
520   IF Answer$="Y" THEN GOTO 460
530   IF Region$="R" THEN Region_name$="RICHMOND"
540   IF Region$="D" THEN Region_name$="DENVER"
550   IF (Region$="R") AND (Quad$="C") THEN Quad_name$="CHESTERFIELD"
```

```
560   IF (Region$="R") AND (Quad$="S") THEN Quad_name$="SEVEN PINES"
570   IF Region$="D" THEN Quad_name$="FITZSIMMONS"
580   PRINTER IS 11
590   PRINT Region_name$;TAB(20);Quad_name$;LIN(1);"GRID ";Grid_number
600   PRINT "
      "
610   PRINTER IS 16
620   CALL Print_out(Land_cover$(*),No_scan_lines,No_elements,11)
630   Answer$="N"
640   INPUT "ANY ERRORS? (Y/N)",Answer$
650   IF Answer$="Y" THEN GOTO 460
660   Answer$="Y"
670   INPUT "WOULD YOU LIKE THESE ON DISK? (Y/N)",Answer$
680   IF Answer$="Y" THEN ASSIGN #1 TO Region$&Quad$&VAL$(Grid_number)&":F8",Ret
urn_variable
690   IF (Answer$="Y") AND (Return_variable=1) THEN CREATE Region$&Quad$&VAL$(Gr
id_number)&":F8",1,No_scan_lines*No_elements*6+4
700   IF Answer$="Y" THEN ASSIGN #1 TO Region$&Quad$&VAL$(Grid_number)&":F8"
710   IF Answer$="Y" THEN MAT PRINT #1;Land_cover$
720   END
730   SUB Print_out(Land_cover$(*),No_scan_lines,No_elements,Unit)
740     OPTION BASE 1
750     DIM Dummy$(26)[1],Dummy2$(26)[1]
760     REDIM Dummy$(No_elements),Dummy2$(No_elements)
770     PRINT PAGE
780     PRINTER IS Unit
790     IF No_elements=16 THEN PRINT RPT$(CHR$(228),18),RPT$(CHR$(228),18)
800     IF No_elements=26 THEN PRINT RPT$(CHR$(228),28),RPT$(CHR$(228),28)
810     FOR I=1 TO No_scan_lines
820       FOR J=1 TO No_elements
830         Dummy$(J)=Land_cover$(I,J)[1;1]
840         Dummy2$(J)=Land_cover$(I,J)[2;1]
850       NEXT J
860       IF No_scan_lines=13 THEN PRINT USING "A,16(A),A,12X,A,16(A),A";CHR$(23
1),Dummy$(*),CHR$(231),Dummy2$(*),CHR$(231)
870       IF No_scan_lines=21 THEN PRINT USING "A,26(A),A,12X,A,26(A),A";CHR$(23
1),Dummy$(*),CHR$(231),Dummy2$(*),CHR$(231)
880     NEXT I
890     IF No_elements=16 THEN PRINT RPT$(CHR$(228),18),RPT$(CHR$(228),18)
900     IF No_elements=26 THEN PRINT RPT$(CHR$(228),28),RPT$(CHR$(228),28)
910     PRINTER IS 16
920   SUBEND
930       ! *****************************************************************
**
940       ! *
 *
950       ! *                              E N D
 *
960       ! *
 *
970       ! *****************************************************************
**
```

BLKFND

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```
10    ! RE-STORE "BLKFND"
20    ! ************************************************************************
30    ! ************************************************************************
40    ! ************************* B L K F N D **********************************
50    ! ************************************************************************
60    ! ************************************************************************
70    ! *                                                                      *
80    ! *       THIS PROGRAM IS DESIGNED TO LOCATE ALL CONTIGUOUS BLOCKS       *
90    ! *       OF GROUND TRUTH PIXELS BELONGING TO THE SAME LAND COVER        *
100   ! *       CLASS NOT ON THE BOUNDARY OF THE BLOCK. EACH DISTINCT GROUP    *
110   ! *       IS IDENTIFIED, AND THE TOTAL NUMBER OF PIXELS IN THAT BLOCK
 *
120   ! *       IS PRINTED.                                                    *
130   ! *                                                                      *
140   ! *       WRITTEN UNDER NASA CONTRACT NAS5-26111 BY:                     *
150   ! *                                                                      *
160   ! *                       RICHARD G. CRAIG                               *
170   ! *                     DEPARTMENT OF GEOLOGY                            *
180   ! *                     KENT STATE UNIVERSITY                            *
190   ! *                       KENT, OHIO 44242                               *
200   ! *                                                                      *
210   ! ************************************************************************
220   OPTION BASE 1
230   DIM Kounts(546),Pixel$(13,16),Group(13,16),Symbol$(546)[2],Neighbors(8,2),
Region$[1],Quad$[1]
240   INPUT "WHAT REGION? (D=DENVER, R=RICHMOND)",Region$
250   Quad$=""
260   IF Region$="R" THEN INPUT "WHICH QUAD? (S=SEVEN PINES, C=CHESTERFIELD)",Qu
ad$
270   INPUT "WHAT GRID NUMBER?",Grid_number
280   ASSIGN #1 TO Region$&Quad$&VAL$(Grid_number)&":H8,0,1",Return_variable
290   IF Return_variable<>0 THEN PRINT "FILE NOT FOUND"
300   IF Return_variable<>0 THEN 240
310   MAT READ #1;Pixel$
320   Max_group=0
330   No_scan_lines=13
340   No_elements=16
350   MAT Kounts=ZER
360   MAT Group=ZER
370   PRINTER IS 0
380   FOR Scan_line=1 TO No_scan_lines
390     FOR Element=1 TO No_elements
400       CALL Neighborhood(Scan_line,Element,No_scan_lines,No_elements,Neighbor
s(*),Size)
410       Member=0
420       FOR Join=1 TO Size
430         IF Pixel$(Scan_line,Element)=Pixel$(Neighbors(Join,1),Neighbors(Join
,2)) THEN Member=Join
440         IF Member AND (Group(Neighbors(Join,1),Neighbors(Join,2))<>0) THEN E
xit_loop
450       NEXT Join
460       IF NOT Member THEN Max_group=Max_group+1
470       IF NOT Member THEN Group(Scan_line,Element)=Max_group
480       IF NOT Member THEN Symbol$(Max_group)=Pixel$(Scan_line,Element)
490       IF NOT Member THEN 540
500 Exit_loop:IF Member THEN Group(Scan_line,Element)=Group(Neighbors(Member,1),
Neighbors(Member,2))
```

```
510        IF Member AND (Group(Neighbors(Member,1),Neighbors(Member,2))=0) THEN
Max_group=Max_group+1
520        IF Member AND (Group(Neighbors(Member,1),Neighbors(Member,2))=0) THEN
Group(Scan_line,Element)=Max_group
530        IF Member AND (Group(Neighbors(Member,1),Neighbors(Member,2))=0) THEN
Symbol$(Max_group)=Pixel$(Scan_line,Element)
540        Kounts(Group(Scan_line,Element))=Kounts(Group(Scan_line,Element))+1
550        PRINT USING "#,A";CHR$(Group(Scan_line,Element)+64)
560      NEXT Element
570      PRINT
580    NEXT Scan_line
590    Region_name$="DENVER"
600    IF Region$="R" THEN Region_name$="RICHMOND"
610    Quad_name$=""
620    IF Quad$="C" THEN Quad_name$="CHESTERFIELD"
630    IF Quad$="S" THEN Quad_name$="SEVEN PINES"
640    PRINT LIN(2),"REGION...";Region_name$,SPA(10),Quad_name$
650    PRINT "GRID...";Grid_number,LIN(2)
660    CALL Output(Symbol$(*),Kounts(*),Max_group)
670    PRINTER IS 16
680    BEEP
690    DISP "ALL DONE"
700    END
710    SUB Neighborhood(Scan_line,Element,No_scan_lines,No_elements,Neighbors(*),
Size)
720      OPTION BASE 1
730      Size=0
740      FOR Row=Scan_line-1 TO Scan_line+1
750        IF (Row<1) OR (Row>No_scan_lines) THEN Bypass_row
760        FOR Column=Element-1 TO Element+1
770          IF (Column<1) OR (Column>No_elements) THEN Bypass_column
780          IF (Row=Scan_line) AND (Column=Element) THEN Bypass_column
790          Size=Size+1
800          Neighbors(Size,1)=Row
810          Neighbors(Size,2)=Column
820 Bypass_column:NEXT Column
830 Bypass_row:NEXT Row
840    SUBEND
850    SUB Output(Symbol$(*),Kounts(*),Max_group)
860      OPTION BASE 1
870      DIM Target_symbol$[2]
880      PRINTER IS 0
890      PRINT "BLOCK      CHARACTER    LAND COVER    NUMBER",LIN(1)
900      FOR I=1 TO Max_group
910        Target_symbol$=Symbol$(I)
920        IF Target_symbol$="" THEN Next_i
930        FOR J=1 TO Max_group
940          IF Target_symbol$=Symbol$(J) THEN PRINT USING "5D,5X,5A,10X,5A,5X,5D
";J,CHR$(J+64),Symbol$(J),Kounts(J)
950          IF Target_symbol$=Symbol$(J) THEN Symbol$(J)=""
960        NEXT J
970        PRINT "........................................"
980 Next_i:NEXT I
990      PRINTER IS 16
1000   SUBEND
1010   ! *****************************************************************
1020   ! *                                                               *
1030   ! *                          E N D                                *
1040   ! *                                                               *
1050   ! *****************************************************************
```

DIFIND

```
10     ! ************************************************************************
20     ! ************************************************************************
30     ! *************************** D I F I N D ********************************
40     ! ************************************************************************
50     ! ************************************************************************
60     ! *                                                                      *
70     ! *      THIS PROGRAM EXAMINES THE GROUND TRUTH DATA FILES TO DETERMINE  *
80     ! *      THE MAXIMUM NUMBER OF PIXELS OF EACH LAND COVER CLASS THAT      *
90     ! *      COULD BE AVAILABLE FOR USE IN THE EXAMINATION OF CLASSIFIER     *
100    ! *      ACCURACY. THIS INFORMATION IS THE BASIS FOR DECISIONS BY THE    *
110    ! *      TEST@ PROGRAM ABOUT WHICH PIXELS ACTUALLY WILL BE USED FOR THE
*
120    ! *      ACCURACY EVALUATION.                                            *
130    ! *                                                                      *
140    ! *      WRITTEN UNDER NASA CONTRACT NAS5-26111 BY:                      *
150    ! *                                                                      *
160    ! *                          RICHARD G. CRAIG                            *
170    ! *                        DEPARTMENT OF GEOLOGY                         *
180    ! *                        KENT STATE UNIVERSITY                         *
190    ! *                          KENT, OHIO 44242                            *
200    ! *                                                                      *
210    ! ************************************************************************
220    OPTION BASE 1
230    DIM Ok(23,27),Useable(23,27),Pixel$(23,27)[2],Symbol$(2)[2],Samples(621,3
,Region$[1],Quad$[1],Location(23,27)
240    DATA "A","L"
250    MAT READ Symbol$
260    Min_dist=9
270 Try_again:Max_sl=21
280    Max_el=26
290    Region$="D"
300    INPUT "WHAT REGION? (D=DENVER, R=RICHMOND)",Region$
310    Quad$=""
320    IF Region$="D" THEN
330      PRINTER IS 16
340      PRINT TAB(35),"************************"
350      PRINT TAB(35),"1=FITZSIMMONS"
360      PRINT TAB(35),"2=HIGHLAND RANCH"
370      PRINT TAB(35),"3=SABLE"
380      PRINT TAB(35),"4=EAST LAKE"
390      PRINT TAB(35),"5=LITTLETON"
400      PRINT TAB(35),"6=COMMERCE CITY"
410      PRINT TAB(35),"************************"
420    END IF
430    Quad=3
440    IF Region$="D" THEN
450      INPUT "WHICH QUAD? (1,2,3,4,5,6)",Quad
460      DATA "FITZSIMMONS","HIGHLAND RANCH","SABLE","EAST LAKE","LITTLETON","COM
MERCE CITY"
470      DIM Quad_names$(6)
480      MAT READ Quad_names$
490      Quad_name$=Quad_names$(Quad)
500    END IF
510    IF Region$="R" THEN INPUT "WHICH QUAD? (S=SEVEN PINES, C=CHESTERFIELD)",Qu
ad$
520    Grid=1
530    INPUT "WHAT GRID NUMBER?",Grid
```

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```
540   IF Region$="D" THEN
550     IF Quad=4 THEN
560       IF (Grid=2) OR (Grid=5) THEN Max_el=25
570     END IF
580     IF (Quad=6) AND (Grid=2) THEN Max_el=25
590     IF Quad=2 THEN
600       IF Grid=7 THEN
610         Max_sl=23
620         Max_el=27
630       END IF
640       IF Grid=8 THEN Max_sl=23
650       IF Grid=9 THEN Max_sl=22
660     END IF
670     IF (Quad=5) AND (Grid=7) THEN Max_sl=22
680   END IF
690   IF Region$="R" THEN
700     ASSIGN #1 TO Region$&Quad$&VAL$(Grid)&":H8,0,1",Return_variable
710     Max_sl=13
720     Max_el=16
730   END IF
740   DIM File_names$(6)
750   DATA "D","RANCH","SABLE","E.LKE","LITLN","CCITY"
760   MAT READ File_names$
770   IF Region$="D" THEN
780     File_name$=File_names$(Quad)
790     File_name$=File_name$&VAL$(Grid)&":H8,0,1"
800     ASSIGN #1 TO File_name$,Return_variable
810   END IF
820   IF Return_variable THEN PRINT "FILE NOT FOUND"
830   IF Return_variable THEN Try_again
840   REDIM Pixel$(Max_sl,Max_el)
850   REDIM Ok(Max_sl,Max_el)
860   REDIM Useable(Max_sl,Max_el)
870   REDIM Location(Max_sl,Max_el)
880   REDIM Samples(Max_sl*Max_el,3)
890   MAT READ #1;Pixel$
900   Min_dist=9
910   INPUT "WHAT DISTANCE SHOULD SEPARATE SAMPLES? (DEFAULT IS 9)",Min_dist
920   PRINTER IS 0
930   Region_name$="DENVER"
940   IF Region$="R" THEN Region_name$="RICHMOND"
950   IF Quad$="S" THEN Quad_name$="SEVEN PINES"
960   IF Quad$="C" THEN Quad_name$="CHESTERFIELD"
970   PRINT LIN(4),"REGION...";Region_name$;"      ";Quad_name$
980   PRINT "GRID.....";Grid,LIN(2)
990   PRINTER IS 16
1000  CALL Centers(Max_sl,Max_el,Useable(*),Pixel$(*))
1010  PRINTER IS 0
1020  PRINT LIN(2),"COUNT      SYMBOL      SCAN LINE      ELEMENT"
1030  PRINTER IS 16
1040  MAT Location=(255)
1050  Kount=0
1060  FOR Class=1 TO 2
1070    MAT Ok=(1)
1080    Class_kount=0
1090    FOR Sl=1 TO Max_sl
1100      FOR El=1 TO Max_el
1110        IF (Class_kount>=4) AND (Min_dist=1) THEN 1260
1120        Want=0
```

```
1130      IF (Pixel$(S1,E1)=Symbol$(Class)) AND Ok(S1,E1) AND Useable(S1,E1) T
HEN Want=1
1140        IF Want THEN
1150          CALL Neighbors(S1,E1,Ok(*),Min_dist,Max_s1,Max_e1)
1160          Kount=Kount+1
1170          Class_kount=Class_kount+1
1180          Samples(Kount,1)=S1
1190          Samples(Kount,2)=E1
1200          Samples(Kount,3)=Class
1210          Location(S1,E1)=NUM(Symbol$(Class))
1220          PRINTER IS 0
1230          PRINT USING "5D,7X,2A,10X,DD,12X,DD";Kount,Symbol$(Class),S1,E1
1240          PRINTER IS 16
1250        END IF
1260      NEXT E1
1270      PRINT
1280    NEXT S1
1290    PRINTER IS 0
1300    IF Class_kount THEN PRINT "....................................."
1310    PRINTER IS 16
1320  NEXT Class
1330  PRINTER IS 0
1340  PRINT LIN(2),"LOCATIONS OF SAMPLES USEABLE AT A DISTANCE OF ";Min_dist,L
IN(2)
1350  Unit=0
1360  INPUT "WHAT UNIT SHOULD I OUTPUT THE INFORMATION TO? (0=THERMAL,16=CRT)"
,Unit
1370  CALL Output(Location(*),Max_s1,Max_e1,Unit)
1380  PRINTER IS 16
1390  Disk_copy$="N"
1400  INPUT "DO YOU WANT THESE COORDINATES STORED? (Y/N)",Disk_copy$
1410  IF Disk_copy$="Y" THEN
1420    Test_type$="DC"
1430    IF Min_dist=1 THEN Test_type$="CC"
1440    File_name$=Test_type$&Region$&Quad$&VAL$(Grid)&":H8,0,1"
1450    CREATE File_name$,Kount*3+1,8
1460    REDIM Samples(Kount,3)
1470    ASSIGN #2 TO File_name$
1480    PRINT #2;Kount
1490    MAT PRINT #2;Samples
1500    ASSIGN * TO #2
1510    BEEP
1520    PRINT #Unit;"COORDINATES ARE STORED IN FILE "&File_name$
1530  END IF
1540  END
1550  SUB Neighbors(S1,E1,Ok(*),Min_dist,Max_s1,Max_e1)
1560    OPTION BASE 1
1570    FOR I=1 TO Max_s1
1580      FOR J=1 TO Max_e1
1590        IF FNDist(S1,E1,I,J)<Min_dist THEN Ok(I,J)=0
1600      NEXT J
1610    NEXT I
1620  SUBEND
1630  DEF FNDist(S1,E1,I,J)
1640    Dist=((S1-I)^2+(E1-J)^2)^.5
1650    RETURN Dist
1660  FNEND
1670  SUB Neighborhood(S1,E1,Max_s1,Max_e1,Border(*),Size)
1680    OPTION BASE 1
```

```
1690    Size=0
1700    FOR R=S1-1 TO S1+1
1710      IF (R<1) OR (R>Max_s1) THEN Bypass_r
1720      FOR C=E1-1 TO E1+1
1730        IF (C<1) OR (C>Max_e1) THEN Bypass_c
1740        IF (R=S1) AND (C=E1) THEN Bypass_c
1750        Size=Size+1
1760        Border(Size,1)=R
1770        Border(Size,2)=C
1780 Bypass_c:NEXT C
1790 Bypass_r:NEXT R
1800  SUBEND
1810  SUB Centers(Max_sl,Max_el,Useable(*),Pixel$(*))
1820    OPTION BASE 1
1830    DIM Border(8,2)
1840    PRINTER IS 0
1850    PRINT "PIXELS NOT ON THE BORDER OF A CLASS BLOCK",LIN(2)
1860    FOR I=1 TO Max_sl
1870      FOR J=1 TO Max_el
1880        Useable(I,J)=1
1890        Number_the_same=0
1900        CALL Neighborhood(I,J,Max_sl,Max_el,Border(*),Size)
1910        FOR K=1 TO Size
1920          IF Pixel$(I,J)<>Pixel$(Border(K,1),Border(K,2)) THEN Useable(I,J)=
0
1930          IF Pixel$(I,J)=Pixel$(Border(K,1),Border(K,2)) THEN Number_the_sam
e=Number_the_same+1
1940        NEXT K
1950        IF Number_the_same<0 THEN Useable(I,J)=0
1960        PRINT USING "#,D";Useable(I,J)
1970      NEXT J
1980      PRINT
1990    NEXT I
2000    PRINT LIN(2)
2010    PRINTER IS 16
2020  SUBEND
2030  SUB Output(Location(*),Max_sl,Max_el,Unit)
2040    OPTION BASE 1
2050    PRINTER IS Unit
2060    FOR I=1 TO Max_sl
2070      FOR J=1 TO Max_el
2080        PRINT USING "#,A";CHR$(Location(I,J))
2090      NEXT J
2100      PRINT
2110    NEXT I
2120    PRINT LIN(2)
2130    PRINTER IS 16
2140  SUBEND
```

SIGNAD

```
10    ! RE-STORE "SIGNAD"
20    ! ************************************************************************
30    ! ************************************************************************
40    ! ********************** S I G N A D *************************************
50    ! ************************************************************************
60    ! ************************************************************************
70    ! *                                                                      *
80    ! *     THIS PROGRAM COMBINES STATISTICS FROM INDIVIDUALLY DEVELOPED    *
90    ! *     SIGNATURES TO PRODUCE A SINGLE SIGNATURE FOR USE IN THE          *
100   ! *     CLASSIFICATION OF LANDSAT DATA.                                  *
110   ! *                                                                      *
120   ! *     WRITTEN UNDER NASA CONTRACT NAS5-26111 BY:                       *
130   ! *                                                                      *
140   ! *                        RICHARD G. CRAIG                              *
150   ! *                      DEPARTMENT OF GEOLOGY                           *
160   ! *                      KENT STATE UNIVERSITY                           *
170   ! *                        KENT, OHIO 44242                              *
180   ! *                                                                      *
190   ! ************************************************************************
200   INPUT "STANDARD DEVIATION MULTIPLIER?",K
210   FIXED 2
220   Sums=0
230   Sumsq=0
240   Ns=0
250   INPUT "IDENTIFIER FOR THIS SIGNATURE?",Identifier$
260   INPUT "MEAN?",Mean
270   INPUT "VARIANCE?",Variance
280   INPUT "SAMPLE SIZE?",N
290   Ns=Ns+N
300   Sum=Mean*N
310   Sums=Sums+Sum
320   Sumsq=Sum^2/N+(N-1)*Variance
330   Sumssq=Sumssq+Sumsq
340   Answer$="Y"
350   INPUT "ADD ANOTHER SIGNATURE? (Y/N)",Answer$
360   IF Answer$="Y" THEN 260
370   Mean=Sums/Ns
380   Variance=(Sumssq-Sums^2/Ns)/(Ns-1)
390   Standard_dev=Variance^.5
400   Upper=Mean+K*Standard_dev
410   Lower=Mean-K*Standard_dev
420   PRINTER IS 0
430   PRINT Identifier$
440   PRINT "MEAN=";Mean;"  VARIANCE=";Variance;"   STANDARD DEVIATION=";Standar
d_dev
450   PRINT "UPPER=";Upper;"  LOWER=";Lower;LIN(1)
460   PRINTER IS 16
470   Answer$="Y"
480   INPUT "COMPUTE ANOTHER SIGNATURE? (Y/N)",Answer$
490   IF Answer$="Y" THEN 210
500   BEEP
510   END
520   ! ************************************************************************
530   ! *                                                                      *
540   ! *                           E N D                                      *
550   ! *                                                                      *
560   ! ************************************************************************
```

TEST@

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```
10    ! RE-STORE "TEST@:H8,0,0"
20    ! *******************************************************************+
30    ! *******************************************************************+
40    ! ************************* T E S T @ *******************************+
50    ! *******************************************************************+
60    ! *******************************************************************+
70    ! *                                                                   *
80    ! *      THIS PROGRAM CHOOSES APPROPRIATE PIXELS FOR TESTING CLASSIFIER *
90    ! *      ACCURACY, SUBJECT TO CONSTRAINTS ON THE PROBABILITY OF        *
100   ! *      SELECTION, TOTAL NUMBER DESIRED, AND SAMPLE SPACING. THE      *
110   ! *      PIXELS CHOSEN ARE OUTPUT TO A DISK FILE FOR USE IN THE ABSTAT
+
120   ! *      PROGRAM.                                                      +
130   ! *                                                                    +
140   ! *      WRITTEN UNDER NASA CONTRACT NAS5-26111 BY:                    +
150   ! *                                                                    +
160   ! *                        RICHARD G. CRAIG                            *
170   ! *                     DEPARTMENT OF GEOLOGY                          +
180   ! *                     KENT STATE UNIVERSITY                          +
190   ! *                        KENT, OHIO 44242                            +
200   ! *                                                                    +
210   ! *******************************************************************+
220   BEEP
230   DISP "DIMENSIONING THE ARRAYS"
240   OPTION BASE 1
250   PRINTER IS 16
260   PRINT PAGE
270   COM Quad_names$(8),Begin_quad(3),End_quad(3),Begin_grid(8),Number_of_grids
(8)
280   DIM Ok(21,26),Useable(21,26),Location(21,26),Pixel$(21,26)[2]
290   DIM Samples(500,5),Border(8,2)
300   DIM Denver_count(20),Richmond_count(20)
310   DIM Denver_symbol$(20)[2],Richmond_symbol$(20)[2],Phase_2_symbol$(20)[2]
320   DIM Symbol$(20)[2]
330   DIM Phase_two_count(20)
340   DIM Class_kount(20),Cut_off_count(20)
350   DIM Max_sl(8,12),Max_el(8,12)
360   DIM File_names$(8),Region_names$(3),Test_type_names$(2)[1]
370   DIM Number_quads_in(3),No_symbols_per(3)
380   ! *******************************************************************+
390   ! *                                                                    +
400   ! *      THE NEXT SEGMENT IS DESIGNED TO INITIALIZE THE DATA SETS TO BE +
410   ! *      USED.                                                         *
420   ! *                                                                    +
430   ! *******************************************************************+
440   BEEP
450   DISP "INITIALIZING THE VECTORS"
460   DATA "L","A","U","B","C","D","H","HN","LN","CN","R+","R","L-","G","H-","L-
","T","E","F","W"
470   MAT READ Richmond_symbol$
480   DATA "C","L","U","B","A","D","H","HN","LN","CN","R+","P","E","R","F","G","
P","M","T"," "
490   MAT READ Denver_symbol$
500   DATA "A","U","R","O","C","D","$","W","B","^","+","T","#"," "," "," "," ","
"," "," "
510   MAT READ Phase_2_symbol$
520   DATA 5,8,0,1,1,3,0,0,0,1,0,0,2,0,0,0,1,0,29,0
530   MAT READ Richmond_count
540   DATA 8,5,0,2,4,6,1,0,3,1,1,6,0,2,0,0,1,0,0,0
```

```
550   MAT READ Denver_count
560   DATA 25,30,50,21,8,6,5,3,3,3,2,1,1,0,0,0,0,0,0,0
570   MAT READ Phase_two_count
580   MAT Begin_grid=CON
590   DATA 9,9,8,6,9,3,12,12
600   MAT READ Number_of_grids
610   DATA   "FITZSIMMONS","HIGHLAND RANCH","SABLE","EAST LAKE","LITTLETON","COM
MERCE CITY","SEVEN PINES","CHESTERFIELD"
620   MAT READ Quad_names$
630   DATA "D","RANCH","SABLE","E.LKE","LITLN","CCITY","RS","RC"
640   MAT READ File_names$
650   DATA 2,1,5
660   MAT READ Number_quads_in
670   DATA 7,1,2
680   MAT READ Begin_quad
690   DATA 8,1,6
700   MAT READ End_quad
710   DATA "PHASE I,  RICHMOND","PHASE I,  DENVER","PHASE II, DENVER"
720   MAT READ Region_names$
730   DATA 20,20,13
740   MAT READ No_symbols_per
750   DATA "D","B"
760   MAT READ Test_type_names$
770   Number_regions=3
780   Number_of_quads=8
790   Number_of_tests=2
800   Cut_off_prob=1/Number_of_tests
810   ! *******************************************************************
820   ! *                                                                 *
830   ! *       THE FOLLOWING SEGMENT DETERMINES THE DESIRED PARAMETERS OF   *
840   ! *       THIS RUN. THEY ARE UNDER USER CONTROL.                    *
850   ! *                                                                 *
860   ! *******************************************************************
870   BEEP
880   DISP "READY"
890   REPEAT
900     Unit=16
910     BEEP
920     INPUT "WHERE WOULD YOU LIKE THE RESULTS PRINTED? (0=THERMAL, 16=CRT)",
Unit
930     Unit=INT(Unit)
940   UNTIL (Unit=0) OR (Unit=16)
950   PRINTER IS 16
960   PRINT LIN(6)
970   PRINT TAB(25),"************************"
980   FOR I=1 TO Number_regions
990     PRINT TAB(25);I;" = ";Region_names$(I)
1000  NEXT I
1010  PRINT TAB(25),"************************"
1020  REPEAT
1030    Region=3
1040    BEEP
1050    INPUT "WHICH REGION IS TO BE STUDIED? (1,2,3)",Region
1060    Region=INT(Region)
1070  UNTIL (Region>0) AND (Region<4)
1080  No_of_classes=No_symbols_per(Region)
1090  REPEAT
1100    Min_dist=9
1110    BEEP
```

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```
1120    INPUT "WHAT DISTANCE SHOULD SEPARATE SAMPLES? (0<=DISTANCE<28,DEFAULT IS
 5)",Min_dist
1130    Min_dist=INT(Min_dist)
1140  UNTIL (Min_dist>=0) AND (Min_dist<28)
1150  REPEAT
1160    Look_at_all$="Y"
1170    BEEP
1180    INPUT "I ASSUME YOU WANT TO LOOK AT ALL OF THIS REGION, IS THAT RIGHT?
 (Y/N)",Look_at_all$
1190  UNTIL (Look_at_all$="Y") OR (Look_at_all$="N")
1200  IF Look_at_all$="N" THEN
1210    CALL Look_at_part_of(Region)
1220  END IF
1230  ! ********************************************************************
1240  ! *                                                                  *
1250  ! *    THE NEXT SEGMENT INITIALIZES VECTORS TO ADJUST FOR UNEQUAL GRID *
1260  ! *    SIZES IN THE VARIOUS QUADRANGLES.                               *
1270  ! *                                                                  *
1280  ! ********************************************************************
1290  BEEP
1300  DISP "INITIALIZING THE SCAN LINE AND ELEMENT ARRAYS, AND CUT OFF VALUES"
1310  FOR Quadrangle=Begin_quad(Region) TO End_quad(Region)
1320    FOR Grid=Begin_grid(Quadrangle) TO Number_of_grids(Quadrangle)
1330      IF Quadrangle<7 THEN
1340        Max_sl(Quadrangle,Grid)=21
1350        Max_el(Quadrangle,Grid)=26
1360      END IF
1370      IF Quadrangle=4 THEN
1380        IF (Grid=2) OR (Grid=5) THEN Max_el(Quadrangle,Grid)=25
1390      END IF
1400      IF (Quadrangle=6) AND (Grid=2) THEN Max_el(Quadrangle,Grid)=25
1410      IF Quadrangle>6 THEN
1420        Max_sl(Quadrangle,Grid)=13
1430        Max_el(Quadrangle,Grid)=16
1440      END IF
1450    NEXT Grid
1460  NEXT Quadrangle
1470  FOR I=1 TO No_symbols_per(Region)
1480    IF Region=1 THEN Symbol$(I)=Richmond_symbol$(I)
1490    IF Region=2 THEN Symbol$(I)=Denver_symbol$(I)
1500    IF Region=3 THEN Symbol$(I)=Phase_2_symbol$(I)
1510  NEXT I
1520  IF Region=1 THEN
1530    MAT Cut_off_count=Richmond_count
1540  END IF
1550  IF Region=2 THEN
1560    MAT Cut_off_count=Denver_count
1570  END IF
1580  IF Region=3 THEN
1590    MAT Cut_off_count=Phase_two_count
1600  END IF
1610  ! ********************************************************************
1620  ! *                                                                  *
1630  ! *     THE FOLLOWING SEGMENT CONSTITUTES THE MAIN PORTION OF THE CODE. *
1640  ! *                                                                  *
1650  ! *     SAMPLES ARE CHOSEN AS DESIRED AND CAN THEN BE OUTPUT TO A DISK. *
1660  ! *                                                                  *
1670  ! ********************************************************************
```

```
1680  BEEP
1690  DISP "IS THE GROUND TRUTH DISK IN THE RIGHT HAND DRIVE? (PRESS CONT)"
1700  PAUSE
1710  FOR Test_type=1 TO Number_of_tests
1720    Kount=0
1730    PRINTER IS 16
1740    PRINT PAGE
1750    PRINT "NOW SEARCHING FOR PIXELS FOR TEST NUMBER ";Test_type
1760    MAT Samples=ZER
1770    MAT Class_kount=ZER
1780    FOR Quadrangle=Begin_quad(Region) TO End_quad(Region)
1790      FOR Grid=Begin_grid(Quadrangle) TO Number_of_grids(Quadrangle)
1800        IF SUM(Class_kount)<SUM(Cut_off_count) THEN
1810          PRINTER IS Unit
1820          PRINT LIN(4),TAB(20),"REGION...";Region_name$(Region);"      ";Quad
_names$(Quadrangle)
1830          PRINTER IS 16
1840          File_name$=File_names$(Quadrangle)&VAL$(Grid)&":H8,0,1"
1850          ASSIGN #1 TO File_name$,Return_variable
1860          IF Return_variable THEN
1870 Wrong:     PRINT "FILE NOT FOUND    ";File_name$
1880            BEEP
1890            STOP
1900          END IF
1910          REDIM Pixel$(Max_sl(Quadrangle,Grid),Max_el(Quadrangle,Grid))
1920          REDIM Ok(Max_sl(Quadrangle,Grid),Max_el(Quadrangle,Grid))
1930          REDIM Useable(Max_sl(Quadrangle,Grid),Max_el(Quadrangle,Grid))
1940          REDIM Location(Max_sl(Quadrangle,Grid),Max_el(Quadrangle,Grid))
1950          ON END #1 GOTO Wrong
1960          MAT READ #1;Pixel$
1970          PRINTER IS Unit
1980          PRINT LIN(2),TAB(20),"GRID.....";Grid,LIN(2)
1990          BEEP
2000          CALL Centers(Max_sl(Quadrangle,Grid),Max_el(Quadrangle,Grid),Useab
le(*),Pixel$(*),Unit)
2010          PRINTER IS Unit
2020          BEEP
2030          PRINT LIN(2),"COUNT     SYMBOL     SCAN LINE     ELEMENT     GRID
       QUADRANGLE   "
2040          PRINTER IS 16
2050          MAT Location=(255)
2060          MAT Ok=(1)
2070          FOR Sl=2 TO Max_sl(Quadrangle,Grid)-1
2080            FOR Starting_el=2 TO Max_el(Quadrangle,Grid)-1
2090              MAT SEARCH Useable(Sl,*),LOC(=1);El,Starting_el
2100              IF El<Max_el(Quadrangle,Grid) THEN
2110                IF Ok(Sl,El) THEN
2120                  MAT SEARCH Symbol$(*),LOC(=Pixel$(Sl,El));Class
2130                  IF Class<No_of_classes THEN
2140                    IF Class_kount(Class)<Cut_off_count(Class) THEN
2150                      IF RND<Cut_off_prob THEN
2160                        Kount=Kount+1
2170                        Class_kount(Class)=Class_kount(Class)+1
2180                        Samples(Kount,1)=Sl
2190                        Samples(Kount,2)=El
2200                        Samples(Kount,3)=Class
2210                        Samples(Kount,4)=Quadrangle
2220                        Samples(Kount,5)=Grid
2230                        Location(Sl,El)=NUM(Symbol$(Class))
```

```
2240                         CALL Neighbors(S1,E1,Ok(*),Min_dist,Max_sl(Quadrangl
e,Grid),Max_el(Quadrangle,Grid))
2250                         PRINTER IS Unit
2260 Format_one:             IMAGE 5D,7X,2A,10X,DD,12X,DD,7X,DD,8X,16A
2270                         PRINT USING Format_one;Class_kount(Class),Symbol$(Cl
ass),S1,E1,Grid,Quad_names$(Quadrangle)
2280                         PRINTER IS 16
2290                       END IF
2300                     END IF
2310                   END IF
2320                 END IF
2330               END IF
2340               Starting_el=E1
2350             NEXT Starting_el
2360           NEXT S1
2370           PRINTER IS Unit
2380           BEEP
2390           PRINT LIN(2),"LOCATIONS OF SAMPLES USEABLE AT A DISTANCE OF ";Mi
n_dist,LIN(2)
2400           CALL Output(Location(*),Max_sl(Quadrangle,Grid),Max_el(Quadrangle,
Grid),Unit)
2410         END IF
2420       NEXT Grid
2430     NEXT Quadrangle
2440     REPEAT
2450       Answer$="N"
2460       INPUT "DO YOU WANT THESE COORDINATES OUTPUT TO A DISK FILE? (Y/N)",A
nswer$
2470     UNTIL (Answer$="Y") OR (Answer$="N")
2480     IF Answer$="Y" THEN
2490       Test_type$=Test_type_names$(Test_type)
2500       File_name$=Test_type$&Region_names$(Region)[7;5]
2510       CREATE File_name$&":H8,0,0",Kount*5+1,8
2520       REDIM Samples(Kount,5)
2530       ASSIGN #2 TO File_name$
2540       PRINT #2;Kount
2550       MAT PRINT #2;Samples
2560       ASSIGN * TO #2
2570       BEEP
2580       PRINT "COORDINATES ARE STORED IN FILE "&File_name$
2590     END IF
2600   NEXT Test_type
2610   PRINT LIN(5)
2620   PRINTER IS 16
2630   BEEP
2640   BEEP
2650   END
2660   ! ************************************************************************
2670   ! *                                                                      *
2680   ! *    THIS SUBROUTINE FLAGS THE CLOSE NEIGHBORS OF A POINT CHOSEN SO    *
2690   ! *    THAT THEY WILL NOT BE AVAILABLE FOR CONSIDERATION.                *
2700   ! *                                                                      *
2710   ! ************************************************************************
2720   SUB Neighbors(S1,E1,Ok(*),Min_dist,Max_sl,Max_el)
2730     OPTION BASE 1
2740     FOR I=MAX(1,S1-Min_dist) TO MIN(Max_sl,S1+Min_dist)
2750       FOR J=MAX(1,E1-Min_dist) TO MIN(Max_el,E1+Min_dist)
2760         IF FNDist(S1,E1,I,J)<Min_dist THEN Ok(I,J)=0
2770       NEXT J
2780     NEXT I
2790   SUBEND
```

```
2600  ! ********************************************************************
2610  ! *                                                                  *
2620  ! *     MEASURES DISTANCE BETWEEN TWO POINTS.                        *
2630  ! *                                                                  *
2640  ! ********************************************************************
2650  DEF FNDist(S1,E1,I,J)
2660    Dist=((S1-I)^2+(E1-J)^2)^.5
2670    RETURN Dist
2680  FNEND
2690  ! ********************************************************************
2700  ! *                                                                  *
2710  ! *     FLAGS PIXELS THAT CAN BE CONSIDERED. PIXELS ON BORDERS OF A  *
2720  ! *     BLOCK ARE TO BE IGNORED.                                     *
2730  ! *                                                                  *
2740  ! ********************************************************************
2750  SUB Centers(Max_sl,Max_el,Useable(*),Pixel$(*),Unit)
2760    OPTION BASE 1
2770    MAT Useable=(1)
2780    PRINTER IS Unit
2790    PRINT "PIXELS NOT ON THE BORDER OF A CLASS BLOCK",LIN(2)
3000    FOR I=2 TO Max_sl
3010      FOR J=2 TO Max_el
3020        IF Pixel$(I,J)<>Pixel$(I-1,J-1) THEN Useable(I,J)=0 AND (Useable(I-1
,J-1)=0)
3030        IF Pixel$(I,J)<>Pixel$(I-1,J) THEN Useable(I,J)=0 AND (Useable(I-1,J
)=0)
3040        IF Pixel$(I,J)<>Pixel$(I,J-1) THEN Useable(I,J)=0 AND (Useable(I,J-1
)=0)
3050        IF Pixel$(I,J-1)<>Pixel$(I-1,J) THEN Useable(I,J-1)=0 AND (Useable(I
-1,J)=0)
3060        PRINT USING "#,D";Useable(I,J)
3070      NEXT J
3080      PRINT
3090    NEXT I
3100    PRINT LIN(2)
3110    PRINTER IS 16
3120  SUBEND
3130  ! ********************************************************************
3140  ! *                                                                  *
3150  ! *     OUTPUTS A CHARACTER GRID REPRESENTING THE SAMPLES CHOSEN.    *
3160  ! *                                                                  *
3170  ! ********************************************************************
3180  SUB Output(Location(*),Max_sl,Max_el,Unit)
3190    OPTION BASE 1
3200    PRINTER IS Unit
3210    FOR I=1 TO Max_sl
3220      FOR J=1 TO Max_el
3230        PRINT USING "#,A";CHR$(Location(I,J))
3240      NEXT J
3250      PRINT
3260    NEXT I
3270    PRINT LIN(2)
3280    PRINTER IS 16
3290  SUBEND
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
3300 ! ************************************************************************
3310 ! *                                                                      *
3320 ! *     ALLOWS STUDY OF JUST A PART OF THE DATA SET AVAILABLE.           *
3330 ! *                                                                      *
3340 ! *                                                                      *
3350 ! ************************************************************************
3360 SUB Look_at_part_of(Region)
3370   OPTION BASE 1
3380   COM Quad_names$(8),Begin_quad(3),End_quad(3),Begin_grid(8),Number_of_gri
ds(8)
3390   PRINTER IS 16
3400   REPEAT
3410     Right_quads$="N"
3420     PRINT PAGE
3430     PRINT TAB(30),"*******************"
3440     FOR I=Begin_quad(Region) TO End_quad(Region)
3450       PRINT TAB(30);I;" ";Quad_names$(I)
3460     NEXT I
3470     PRINT TAB(30),"*******************"
3480     REPEAT
3490       First_quad=Begin_quad(Region)
3500       PRINT "DEFAULT IS QUADRANGLE NUMBER ";Begin_quad(Region)
3510       BEEP
3520       INPUT "WHICH QUADRANGLE WOULD YOU LIKE TO START AT? (N)",First_quad
3530       First_quad=INT(First_quad)
3540     UNTIL (First_quad>=Begin_quad(Region)) AND (First_quad<=End_quad(Regio
n))
3550     IF First_quad<End_quad(Region) THEN
3560       PRINT TAB(30),"*******************"
3570       FOR I=First_quad TO End_quad(Region)
3580         PRINT TAB(30);I;" ";Quad_names$(I)
3590       NEXT I
3600       PRINT TAB(30),"*******************"
3610       PRINT "     THE FIRST QUADRANGLE TO BE STUDIED IS NOW SET AT ";Quad_
names$(First_quad)
3620       REPEAT
3630         Last_quad=End_quad(Region)
3640         PRINT "DEFAULT LAST QUADRANGLE IS ";Last_quad
3650         BEEP
3660         INPUT "WHICH QUADRANGLE WOULD YOU LIKE TO END AT? (N)",Last_quad
3670         Last_quad=INT(Last_quad)
3680       UNTIL (Last_quad>=First_quad) AND (Last_quad<=End_quad(Region))
3690       IF Last_quad>First_quad THEN
3700         PRINT "     THE LAST QUADRANGLE TO BE STUDIED IS NOW SET AT ";Quad
_names$(Last_quad)
3710       ELSE
3720         PRINT "     THE SINGLE QUADRANGLE TO BE STUDIED IS NOW SET AT ";Qu
ad_names$(Last_quad)
3730       END IF
3740     ELSE
3750       Last_quad=End_quad(Region)
3760       PRINT "     THE SINGLE QUADRANGLE TO BE STUDIED IS NOW SET AT ";Quad
_names$(First_quad)
3770     END IF
3780     BEEP
3790     INPUT "HAVE YOU CHOSEN THE CORRECT QUADRANGLES? (Y/N)",Right_quads$
3800   UNTIL Right_quads$="Y"
3810   Begin_quad(Region)=First_quad
3820   End_quad(Region)=Last_quad
```

```
3830     REPEAT
3840       Right_grids$="N"
3850       PRINT PAGE
3860       FOR I=Begin_quad(Region) TO End_quad(Region)
3870         PRINT "FOR THE ";Quad_names$(I);" QUADRANGLE"
3880         REPEAT
3890           First_grid=Begin_grid(I)
3900           PRINT "      DEFAULT BEGINNING GRID IS ";First_grid
3910           BEEP
3920           INPUT "WHICH GRID WOULD YOU LIKE TO START WITH? (N)",First_grid
3930           First_grid=INT(First_grid)
3940         UNTIL (First_grid>=Begin_grid(I)) AND (First_grid<=Number_of_grids(I
))
3950         Begin_grid(I)=First_grid
3960         IF Begin_grid(I)<Number_of_grids(I) THEN
3970           PRINT "            STARTING GRID IS NOW SET TO ";First_grid
3980           REPEAT
3990             Last_grid=Number_of_grids(I)
4000             PRINT "      DEFAULT ENDING GRID IS ";Last_grid
4010             BEEP
4020             INPUT "WHICH GRID WOULD YOU LIKE TO END WITH? (N)",Last_grid
4030             Last_grid=INT(Last_grid)
4040           UNTIL (Last_grid>=Begin_grid(I)) AND (Last_grid<=Number_of_grids(I
))
4050           IF Last_grid>First_grid THEN
4060             PRINT "            ENDING GRID IS NOW SET TO ";Last_grid
4070           ELSE
4080             PRINT "            THE SINGLE GRID TO BE STUDIED IS ";Last_grid
4090           END IF
4100         ELSE
4110           Last_grid=Number_of_grids(I)
4120           PRINT "            THE SINGLE GRID TO BE STUDIED IS ";Number_of_grid
s(I)
4130         END IF
4140         Number_of_grids(I)=Last_grid
4150       NEXT I
4160       BEEP
4170       INPUT "HAVE YOU GOT THE RIGHT GRIDS CHOSEN? (Y/N)",Right_grids$
4180     UNTIL Right_grids$="Y"
4190     BEEP
4200   SUBEND
4210   ! ********************************************************************
4220   ! *                                                                  *
4230   ! *                             E N D                                *
4240   ! *                                                                  *
4250   ! ********************************************************************
```

ABSTAT

```
10   ! RE-STORE "ABSTAT"
20   ! **********************************************************************
30   ! **********************************************************************
40   ! ********************** A B S T A T ***********************************
50   ! **********************************************************************
60   ! **********************************************************************
70   ! *                                                                    *
80   ! *      THIS PROGRAM COMPARES DIGITIZED GROUND TRUTH DATA              *
90   ! *      AND THE RESULTS OF CLASSIFICATION OF A LANDSAT IMAGE.
100  ! *      PIXELS ARE COMPARED AT POINTS CHOSEN BY THE "TEST@"            *
110  ! *      PROGRAM. CORRESPONDENCE IS REPORTED BY MEANS OF A CONFUSION    *
120  ! *      TABLE AND NUMEROUS STATISTICS MEASURING VARIOUS ASPECTS OF     *
130  ! *      THE CLASSIFIER ACCURACY.                                       *
140  ! *                                                                    *
150  ! *      WRITTEN UNDER NASA CONTRACT NAS5-26111 BY:                     *
160  ! *                                                                    *
170  ! *                        RICHARD G. CRAIG                            *
180  ! *                     DEPARTMENT OF GEOLOGY                          *
190  ! *                     KENT STATE UNIVERSITY                          *
200  ! *                        KENT, OHIO 44242                            *
210  ! *                                                                    *
220  ! **********************************************************************
230  OPTION BASE 1
240  PRINTER IS 16
250  PRINT PAGE
260  DISP "DIMENSIONING THE ARRAYS"
270  DIM Test_type$[1],Quad$[1],Landsat$(21,26)[1],Test_coords(200,5)
280  DIM Landsat_symbol$(2)[1]
290  DIM Region_names$(3),File_names$(3),Quad_names$(8),Landsat_files$(8)
300  DIM Begin_quad(3),End_quad(3),Begin_grid(8),Number_of_grids(8)
310  DIM Max_sl(8,12),Max_el(8,12),Contingency(3,3),Cont_table(3,3)
320  ! **********************************************************************
330  ! *                                                                    *
340  ! *      THE NEXT SEGMENT IS DESIGNED TO INITIALIZE THE DATA SETS TO    *
350  ! *      BE USED.                                                       *
360  ! *                                                                    *
370  ! **********************************************************************
380  BEEP
390  DISP "INITIALIZING THE VECTORS"
400  DATA "R","A"
410  MAT READ Landsat_symbol$
420  DATA "I  R","I  D","II,D"
430  MAT READ File_names$
440  DATA "PHASE I,  RICHMOND","PHASE I,  DENVER","PHASE II, DENVER"
450  MAT READ Region_names$
460  DATA 7,1,2
470  MAT READ Begin_quad
480  DATA 8,1,6
490  MAT READ End_quad
500  DATA 1,1,1,4,1,1,1,1
510  MAT READ Begin_grid
520  DATA 9,9,8,9,9,3,12,12
530  MAT READ Number_of_grids
540  DATA "LD","HR","S","CC","L","CC","LP","LC"
550  MAT READ Landsat_files$
560  DATA "FITZSIMMONS","HIGHLAND RANCH","SABLE","EAST LAKE","LITTLETON","COMME
RCE CITY","SEVEN PINES","CHESTERFIELD"
570  MAT READ Quad_names$
580  Number_regions=3
590  No_classes=2
600  MAT Contingency=ZER
```

```
610  ! ************************************************************************
620  ! *                                                                      *
630  ! *       THE FOLLOWING SEGMENT DETERMINES THE DESIRED PARAMETERS OF     *
640  ! *       THIS RUN. THEY ARE UNDER USER CONTROL.                         *
650  ! *                                                                      *
660  ! ************************************************************************
670  REPEAT
680    Unit=16
690    BEEP
700    INPUT "WHERE WOULD YOU LIKE THE RESULTS PRINTED (0=THERMAL,16=CRT)",Un
it
710    Unit=INT(Unit)
720  UNTIL (Unit=0) OR (Unit=16)
730  PRINTER IS 16
740  PRINT LIN(6)
750  PRINT TAB(25),"****************************"
760  FOR I=1 TO Number_regions
770    PRINT TAB(25);Region_names$(I)
780  NEXT I
790  PRINT TAB(25),"****************************"
800  REPEAT
810    Region=3
820    BEEP
830    INPUT "WHICH REGION IS TO BE STUDIED?(1,2,3)",Region
840    Region=INT(Region)
850  UNTIL (Region>0) AND (Region<4)
860  ! ************************************************************************
870  ! *                                                                      *
880  ! *      THE NEXT SEGMENT INITIALIZES VECTORS TO ADJUST FOR UNEQUAL GRID *
890  ! *      SIZES IN THE VARIOUS QUADRANGLES.                               *
900  ! *                                                                      *
910  ! ************************************************************************
920  BEEP
930  DISP "INITIALIZING THE SCAN LINE AND ELEMENT ARRAYS"
940  FOR Quadrangle=Begin_quad(Region) TO End_quad(Region)
950    FOR Grid=Begin_grid(Quadrangle) TO Number_of_grids(Quadrangle)
960      IF Quadrangle<7 THEN
970        Max_sl(Quadrangle,Grid)=21
980        Max_el(Quadrangle,Grid)=26
990      END IF
1000     IF Quadrangle=4 THEN
1010       IF (Grid=5) OR (Grid=8) THEN Max_el(Quadrangle,Grid)=25
1020     END IF
1030     IF (Quadrangle=6) AND (Grid=2) THEN Max_el(Quadrangle,Grid)=25
1040     IF Quadrangle>6 THEN
1050       Max_sl(Quadrangle,Grid)=13
1060       Max_el(Quadrangle,Grid)=16
1070     END IF
1080   NEXT Grid
1090 NEXT Quadrangle
```

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```
1100  ! ********************************************************************
1110  ! *                                                                  *
1120  ! *      THE NEXT SEGMENT DETERMINES THE CORRECT TEST TO BE DONE,     *
1130  ! *      CHECKS THAT THE CORRECT DISK IS IN PLACE AND INPUTS THE      *
1140  ! *      TEST COORDINATE LOCATIONS IN PREPARATION FOR THE ACTUAL TESTS. *
1150  ! *                                                                  *
1160  ! ********************************************************************
1170  REPEAT
1180    Test_type$="B"
1190    BEEP
1200    INPUT "WHICH CLASSIFICATION TECHNIQUE IS TO BE TESTED? (B=BLOCKED, D=D
IFFUSE)",Test_type$
1210  UNTIL (Test_type$="B") OR (Test_type$="D")
1220  PRINTER IS 16
1230  PRINT PAGE
1240  Test_type_name$="BLOCK COORDINATE"
1250  IF Test_type$="D" THEN Test_type_name$="DIFFUSE COORDINATE"
1260  DISP "PUT THE DISK WITH THE COORDINATE FILE IN THE LEFT HAND DISK DRIVE (
CONT)"
1270  BEEP
1280  PAUSE
1290  DISP " "
1300  ASSIGN #1 TO Test_type$&File_names$(Region)&":H8,0,0",Ret_var
1310  IF Ret_var THEN
1320    ASSIGN #1 TO Test_type$&File_names$(Region)&":H8,0,1",Ret_var
1330    IF Ret_var THEN
1340      PRINT "TEST COORDINATE FILE ";Test_type$&File_names$(Region);" NOT FOU
ND"
1350      STOP
1360    END IF
1370  END IF
1380  READ #1;No_test_coords
1390  REDIM Test_coords(No_test_coords,5)
1400  MAT READ #1;Test_coords
1410  Last_grid=Test_coords(1,5)
1420  Last_quad=Test_coords(1,4)
1430  Index=1
1440  ! ********************************************************************
1450  ! *                                                                  *
1460  ! *      THE FOLLOWING SEGMENT CONSTITUTES THE MAIN PORTION OF THE CODE. *
1470  ! *      EACH DESIRED POINT IS TESTED FOR ACCURACY OF THE CLASSIFICATION *
1480  ! *      AND THE RESULTS ARE STORED IN THE CONFUSION TABLE FOR LATER   *
1490  ! *      SUMMARY AND OUTPUT.                                          *
1500  ! *                                                                  *
1510  ! ********************************************************************
1520  DISP "NOW PUT THE SECOND DISK IN THE LEFT HAND DRIVE (CONT)"
1530  BEEP
1540  PAUSE
1550  DISP " "
1560  REPEAT
1570    Quadrangle=Test_coords(Index,4)
1580    Grid=Test_coords(Index,5)
1590    Grid_no=Begin_grid(Quadrangle)+Grid-1
1600    REDIM Landsat$(Max_sl(Quadrangle,Grid_no),Max_el(Quadrangle,Grid_no))
1610    ASSIGN #2 TO Landsat_files$(Quadrangle)&Test_type$&VAL$(Grid_no)&":H8,0,
1",Return_var
1620    IF Return_var THEN
1630      ASSIGN #2 TO Landsat_files$(Quadrangle)&Test_type$&VAL$(Grid_no)&":H8,
0,0",Return_var
```

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```
1640      IF Return_var THEN
1650        PRINT "LANDSAT FILE ";Landsat_files$(Quadrangle)&Test_type$&VAL$(Gri
d_no)&":H8,0,0";" NOT FOUND"
1660        STOP
1670      END IF
1680    END IF
1690    CALL Landsat_input(Landsat$(*),#2,Unit)
1700    MAT Cont_table=ZER
1710    REPEAT
1720      MAT SEARCH Landsat_symbol$(*),LOC(=Landsat$(Test_coords(Index,1),Test_
coords(Index,2)));Mapped_as
1730      IF Test_coords(Index,3)>2 THEN
1740        Really=3
1750      ELSE
1760        Really=Test_coords(Index,3)
1770      END IF
1780      Cont_table(Really,Mapped_as)=Cont_table(Really,Mapped_as)+1
1790      Index=Index+1
1800    UNTIL (Test_coords(Index,5)<>Grid) OR (Test_coords(Index,4)<>Quadrangle)
 OR (Index>No_test_coords)
1810    MAT Contingency=Contingency+Cont_table
1820    PRINTER IS Unit
1830    IF Unit THEN PRINT PAGE
1840    PRINT LIN(2);"**********************************************************+-
+****************",LIN(1)
1850    PRINT Region_names$(Region);TAB(20);Quad_names$(Quadrangle);LIN(1);"GRID
 ";Grid
1860    PRINT "TEST TYPE: ";Test_type_name$
1870    PRINT LIN(3),"CONFUSION TABLE"
1880    CALL Alpha_beta(No_classes+1,Cont_table(*))
1890    PRINT LIN(2);"**********************************************************+-
+****************",LIN(1)
1900    PRINTER IS 16
1910  UNTIL Index=No_test_coords
1920  PRINTER IS Unit
1930  IF Unit THEN PRINT PAGE
1940  PRINT LIN(2);"*************************************************************+-
+-**************",LIN(1)
1950  PRINT Region_name$;TAB(20);Quad_name$;LIN(1)
1960  PRINT "TEST TYPE: ";Test_type_name$
1970  PRINT LIN(4),"CUMULATIVE CONFUSION TABLE"
1980  CALL Alpha_beta(No_classes+1,Contingency(*))
1990  PRINT LIN(2);"*************************************************************+-
***************",LIN(4)
2000  PRINTER IS 16
2010  BEEP
2020  ASSIGN * TO #1
2030  ASSIGN * TO #2
2040  BEEP
2050  END
```

```
2060  ! ********************************************************************
2070  ! *                                                                  *
2080  ! *     THIS SUBROUTINE COMPUTES THE ACCURACY STATISTICS FOR A GIVEN  *
2090  ! *     CONFUSION TABLE AND OUTPUTS THAT INFORMATION.                 *
2100  ! *                                                                  *
2110  ! ********************************************************************
2120  SUB Alpha_beta(Size,Table(*))
2130    OPTION BASE 1
2140    DEFAULT ON
2150    FIXED 2
2160    DIM Row_sum(Size),Column_sum(Size),Omissions(Size),Comissions(Size),Map_
accuracy(Size),Diagonal(Size),Alpha(Size)
2170    DIM Beta(Size),Alpha1(Size),Beta1(Size),Map_accuracy1(Size),Identity(Siz
e,Size),Datum(Size+4),Identity1(Size,Size),Map_accuracy2(Size)
2180    MAT Row_sum=RSUM(Table)
2190    MAT Column_sum=CSUM(Table)
2200    Total=SUM(Table)
2210    MAT Identity=IDN
2220    MAT Identity1=Table.Identity
2230    MAT Diagonal=CSUM(Identity1)
2240    MAT Omissions=Row_sum-Diagonal
2250    MAT Comissions=Column_sum-Diagonal
2260    MAT Alpha=Comissions/Column_sum
2270    MAT Alpha1=Alpha<(9999999999)
2280    MAT Alpha=Alpha1.Alpha
2290    MAT Beta=Omissions/Row_sum
2300    MAT Beta1=Beta<(9999999999)
2310    MAT Beta=Beta1.Beta
2320    MAT Map_accuracy=Diagonal+Omissions
2330    MAT Map_accuracy1=Map_accuracy+Comissions
2340    MAT Map_accuracy2=Diagonal/Map_accuracy1
2350    MAT Map_accuracy1=Map_accuracy2<(999999999)
2360    MAT Map_accuracy=Map_accuracy2.Map_accuracy1
2370    Overall_class=SUM(Diagonal)/Total
2380    IF NOT Total THEN Overall_class=0
2390    MAT Diagonal=Column_sum.Map_accuracy
2400    MAT Diagonal=Diagonal/(Total)
2410    IF NOT Total THEN MAT Diagonal=ZER
2420    Overall_map=SUM(Diagonal)
2430    Ars=SUM(Alpha)
2440    Brs=SUM(Beta)
2450    Mean_alpha=Ars/Size
2460    Mean_beta=Brs/Size
2470    PRINT LIN(1),TAB(24);"MAPPED AS"
2480    PRINT TAB(66),"MAPPING"
2490    PRINT USING "K";"     CLASS          R      A      O      TOTALS      O
MISSIONS    ACCURACIES"
2500    PRINT "T"
2510    N$(1)="R  RESIDENTIAL (R)"
2520    N$(2)="U  AGRICULTURE (A)"
2530    N$(3)="E  OTHER       (O)"
2540    FOR I=1 TO Size
2550      FOR J=1 TO Size
2560        Datum(J)=Table(I,J)
2570      NEXT J
2580      Datum(Size+1)=Row_sum(I)
2590      Datum(Size+2)=Omissions(I)
2600      Datum(Size+3)=Beta(I)
2610      Datum(Size+4)=Map_accuracy(I)
```

```
2620      PRINT USING "18A,1X,DDD,3X,DDD,3X,DDD,5X,DDDD,5X,DDD,4X,D.DD,8X,D.DD";
N$(I),Datum(*)
2630     NEXT I
2640     PRINT
2650     PRINT USING "18A,3X,DDD,3X,DDD,3X,DDD,5X,DDDD,5X,DDD";"TOTALS ",Column
_sum(1),Column_sum(2),Column_sum(3),Total,SUM(Omissions)
2660     PRINT
2670     PRINT USING "18A,4X,DD,4X,DD,4X,DD,5X,DDDD";"COMMISSIONS",Comissions(1
),Comissions(2),Comissions(3),SUM(Comissions)
2680     PRINT
2690     PRINT USING "19X,D.DD,2X,D.DD,2X,D.DD";Alpha(1),Alpha(2),Alpha(3)
2700     PRINT LIN(2),"OVERALL CLASSIFICATION ACCURACY ";Overall_class,TAB(50),"P
(ALPHA ERROR)=";Mean_alpha
2710     PRINT LIN(1),"OVERALL MAPPING ACCURACY         ";Overall_map,TAB(50),"P(B
ETA ERROR) =";Mean_beta
2720     STANDARD
2730     DEFAULT OFF
2740   SUBEND
2750   ! ************************************************************************
2760   ! *                                                                      *
2770   ! *      THIS SUBROUTINE INPUTS THE GRID OF CLASSIFIED LANDSAT DATA      *
2780   ! *      FROM THE APROPRIATE DISK FILE.                                  *
2790   ! *                                                                      *
2800   ! ************************************************************************
2810   SUB Landsat_input(Landsat$(*),#2,Unit)
2820     OPTION BASE 1
2830     DIM Character_input$[40]
2840     PRINTER IS Unit
2850     FOR I=1 TO 4
2860       READ #2;Character_input$
2870     NEXT I
2880     PRINT RPT$("_",COL(Landsat$)+2)
2890     FOR I=1 TO ROW(Landsat$)
2900       Character_input$=RPT$(" ",40)
2910       READ #2;Character_input$
2920       PRINT USING "#,A";"|"
2930       FOR J=1 TO COL(Landsat$)
2940         Landsat$(I,J)=Character_input$[J+6;1]
2950         PRINT USING "#,A";Landsat$(I,J)
2960       NEXT J
2970       PRINT "|"
2980     NEXT I
2990     PRINT RPT$("-",COL(Landsat$)+2)
3000     PRINT " ALL DONE"
3010     PRINTER IS 16
3020   SUBEND
3030   ! ************************************************************************
3040   ! *                                                                      *
3050   ! *                          END                                         *
3060   ! *                                                                      *
3070   ! ************************************************************************
```

Appendix B

Autocorrelations and Partial Autocorrelations of lags 1-10 of the 320 scan lines used in the ANOVA reported. They are arranged as follows:

DENVER ACF

DENVER, TRACK 1, AREA 1, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.94	0.92	0.96	0.97	0.95	0.93	0.89	0.88
2	0.88	0.83	0.92	0.93	0.90	0.85	0.77	0.72
3	0.84	0.77	0.89	0.90	0.87	0.80	0.71	0.61
4	0.82	0.74	0.88	0.88	0.84	0.78	0.68	0.55
5	0.80	0.73	0.87	0.87	0.81	0.75	0.64	0.49
6	0.79	0.72	0.86	0.85	0.79	0.73	0.61	0.44
7	0.77	0.71	0.85	0.84	0.78	0.72	0.58	0.39
8	0.76	0.71	0.85	0.83	0.78	0.71	0.56	0.35
9	0.75	0.70	0.84	0.82	0.77	0.71	0.55	0.32
10	0.74	0.70	0.84	0.82	0.76	0.69	0.54	0.29

DENVER, TRACK 1, AREA 2, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.93	0.93	0.94	0.90	0.93	0.94	0.88	0.91
2	0.84	0.84	0.86	0.73	0.83	0.84	0.72	0.80
3	0.79	0.76	0.80	0.63	0.75	0.77	0.58	0.73
4	0.74	0.68	0.75	0.59	0.68	0.71	0.47	0.67
5	0.68	0.59	0.71	0.56	0.63	0.68	0.40	0.63
6	0.63	0.51	0.68	0.55	0.59	0.65	0.35	0.58
7	0.59	0.46	0.64	0.54	0.55	0.63	0.32	0.54
8	0.55	0.41	0.62	0.54	0.52	0.60	0.29	0.50
9	0.50	0.37	0.59	0.52	0.49	0.58	0.26	0.47
10	0.47	0.35	0.57	0.49	0.47	0.56	0.23	0.44

DENVER, TRACK 1, AREA 3, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.88	0.94	0.93	0.93	0.90	0.92	0.88	0.90
2	0.74	0.86	0.81	0.82	0.76	0.81	0.70	0.76
3	0.67	0.82	0.73	0.73	0.64	0.74	0.58	0.64
4	0.62	0.79	0.68	0.67	0.57	0.69	0.48	0.54
5	0.59	0.76	0.65	0.63	0.51	0.65	0.40	0.46
6	0.58	0.73	0.60	0.60	0.48	0.63	0.34	0.40
7	0.56	0.70	0.54	0.57	0.44	0.60	0.30	0.35
8	0.54	0.68	0.48	0.55	0.40	0.58	0.26	0.29
9	0.50	0.66	0.44	0.52	0.36	0.55	0.21	0.24
10	0.45	0.65	0.41	0.49	0.31	0.53	0.17	0.19

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DENVER, TRACK 1, AREA 4, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.91	0.91	0.93	0.91	0.87	0.92	0.88	0.92
2	0.80	0.79	0.85	0.79	0.70	0.80	0.72	0.80
3	0.72	0.70	0.79	0.69	0.60	0.70	0.60	0.71
4	0.66	0.62	0.76	0.61	0.53	0.64	0.52	0.64
5	0.61	0.56	0.73	0.55	0.50	0.60	0.45	0.59
6	0.58	0.52	0.71	0.51	0.48	0.56	0.40	0.54
7	0.56	0.48	0.69	0.45	0.43	0.51	0.36	0.50
8	0.54	0.45	0.66	0.40	0.39	0.47	0.33	0.46
9	0.52	0.42	0.63	0.35	0.35	0.42	0.31	0.43
10	0.50	0.40	0.60	0.31	0.33	0.38	0.28	0.41

DENVER, TRACK 1, AREA 5, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.91	0.89	0.92	0.94	0.91	0.92	0.93	0.93
2	0.77	0.76	0.80	0.83	0.79	0.80	0.81	0.83
3	0.68	0.66	0.71	0.74	0.70	0.71	0.71	0.74
4	0.61	0.58	0.63	0.6[illegible]	0.64	0.63	0.62	0.67
5	0.55	0.53	0.55	0.60	0.59	0.55	0.53	0.60
6	0.49	0.49	0.48	0.55	0.55	0.50	0.46	0.54
7	0.44	0.44	0.42	0.51	0.52	0.45	0.38	0.49
8	0.39	0.39	0.38	0.47	0.50	0.41	0.32	0.44
9	0.37	0.35	0.34	0.42	0.49	0.37	0.26	0.40
10	0.37	0.31	0.30	0.37	0.47	0.34	0.21	0.37

DENVER, TRACK 2, AREA 1, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.92	0.93	0.92	0.92	0.90	0.81	0.86	0.82
2	0.86	0.87	0.84	0.84	0.80	0.62	0.74	0.63
3	0.81	0.83	0.79	0.79	0.74	0.53	0.69	0.54
4	0.77	0.79	0.76	0.77	0.70	0.48	0.66	0.48
5	0.73	0.76	0.74	0.76	0.67	0.4[illegible]	0.63	0.41
6	0.72	0.72	0.72	0.75	0.66	0.41	0.58	0.38
7	0.70	0.69	0.71	0.73	0.66	0.37	0.54	0.33
8	0.69	0.67	0.70	0.72	0.65	0.33	0.51	0.29
9	0.68	0.64	0.69	0.71	0.64	0.31	0.49	0.28
10	0.68	0.62	0.67	0.70	0.63	0.31	0.48	0.27

DENVER, TRACK 2, AREA 2, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.93	0.93	0.93	0.96	0.94	0.90	0.93	0.89
2	0.85	0.85	0.83	0.90	0.84	0.77	0.82	0.75
3	0.80	0.79	0.76	0.86	0.76	0.70	0.73	0.64
4	0.77	0.74	0.70	0.83	0.71	0.65	0.67	0.56
5	0.75	0.70	0.67	0.80	0.68	0.59	0.62	0.51
6	0.74	0.68	0.65	0.79	0.66	0.52	0.58	0.46
7	0.73	0.66	0.63	0.77	0.64	0.45	0.55	0.41
8	0.72	0.66	0.61	0.76	0.62	0.41	0.52	0.37
9	0.72	0.65	0.59	0.75	0.62	0.38	0.50	0.35
10	0.71	0.64	0.58	0.74	0.61	0.35	0.49	0.34

DENVER, TRACK 2, AREA 3, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.92	0.93	0.95	0.94	0.94	0.92	0.92	0.95
2	0.81	0.83	0.88	0.85	0.86	0.82	0.81	0.88
3	0.73	0.77	0.83	0.78	0.81	0.77	0.71	0.83
4	0.67	0.73	0.79	0.72	0.78	0.75	0.63	0.79
5	0.63	0.70	0.76	0.67	0.74	0.72	0.57	0.76
6	0.61	0.68	0.73	0.63	0.70	0.68	0.52	0.74
7	0.60	0.67	0.71	0.61	0.67	0.63	0.49	0.72
8	0.60	0.66	0.70	0.60	0.64	0.60	0.46	0.71
9	0.59	0.65	0.69	0.59	0.62	0.58	0.43	0.71
10	0.58	0.64	0.68	0.59	0.61	0.57	0.41	0.70

DENVER, TRACK 2, AREA 4, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.90	0.90	0.95	0.94	0.93	0.90	0.92	0.90
2	0.78	0.76	0.86	0.84	0.84	0.73	0.79	0.77
3	0.70	0.65	0.79	0.77	0.77	0.59	0.68	0.67
4	0.62	0.56	0.74	0.71	0.72	0.48	0.59	0.60
5	0.56	0.52	0.70	0.66	0.67	0.38	0.53	0.54
6	0.51	0.50	0.66	0.63	0.63	0.32	0.49	0.48
7	0.48	0.49	0.63	0.61	0.61	0.29	0.46	0.42
8	0.45	0.46	0.61	0.59	0.58	0.27	0.44	0.36
9	0.43	0.45	0.59	0.58	0.56	0.26	0.41	0.30
10	0.42	0.43	0.57	0.56	0.53	0.25	0.38	0.26

ORIGINAL PAGE IS
OF POOR QUALITY

DENVER, TRACK 2, AREA 5, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.88	0.91	0.95	0.94	0.93	0.88	0.91	0.85
2	0.76	0.80	0.88	0.85	0.83	0.68	0.78	0.62
3	0.69	0.71	0.83	0.79	0.75	0.50	0.69	0.46
4	0.64	0.64	0.80	0.75	0.69	0.38	0.62	0.35
5	0.59	0.60	0.78	0.72	0.65	0.30	0.56	0.27
6	0.53	0.56	0.77	0.69	0.63	0.25	0.51	0.21
7	0.49	0.52	0.76	0.66	0.60	0.20	0.46	0.16
8	0.47	0.48	0.73	0.64	0.57	0.14	0.41	0.13
9	0.43	0.44	0.70	0.61	0.54	0.09	0.38	0.12
10	0.39	0.41	0.68	0.57	0.53	0.05	0.35	0.13

DENVER, TRACK 3, AREA 1, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.82	0.86	0.93	0.84	0.83	0.86	0.91	0.86
2	0.65	0.72	0.85	0.67	0.68	0.72	0.81	0.73
3	0.57	0.62	0.78	0.58	0.60	0.63	0.75	0.66
4	0.54	0.55	0.71	0.51	0.52	0.57	0.71	0.60
5	0.49	0.49	0.65	0.44	0.44	0.51	0.68	0.55
6	0.44	0.44	0.60	0.38	0.41	0.46	0.64	0.51
7	0.43	0.39	0.56	0.33	0.38	0.43	0.61	0.47
8	0.43	0.35	0.53	0.29	0.36	0.41	0.59	0.44
9	0.40	0.28	0.51	0.26	0.33	0.38	0.57	0.41
10	0.36	0.24	0.49	0.24	0.30	0.35	0.55	0.39

DENVER, TRACK 3, AREA 2, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.81	0.84	0.87	0.86	0.88	0.85	0.87	0.87
2	0.58	0.63	0.67	0.67	0.71	0.67	0.65	0.68
3	0.42	0.49	0.51	0.53	0.56	0.58	0.48	0.54
4	0.31	0.38	0.39	0.44	0.45	0.55	0.37	0.41
5	0.24	0.30	0.31	0.38	0.35	0.51	0.30	0.31
6	0.20	0.26	0.24	0.32	0.29	0.46	0.26	0.23
7	0.20	0.25	0.19	0.27	0.25	0.41	0.22	0.19
8	0.20	0.26	0.15	0.22	0.23	0.40	0.17	0.16
9	0.20	0.26	0.12	0.18	0.21	0.39	0.14	0.13
10	0.21	0.25	0.10	0.14	0.18	0.37	0.13	0.11

ORIGINAL PAGE IS
OF POOR QUALITY

DENVER, TRACK 3, AREA 3, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.85	0.88	0.90	0.93	0.91	0.89	0.87	0.84
2	0.67	0.73	0.77	0.81	0.80	0.74	0.69	0.64
3	0.53	0.61	0.67	0.72	0.71	0.62	0.56	0.53
4	0.43	0.52	0.59	0.65	0.64	0.52	0.45	0.44
5	0.35	0.46	0.55	0.60	0.58	0.44	0.36	0.36
6	0.30	0.42	0.52	0.57	0.53	0.38	0.28	0.32
7	0.28	0.40	0.52	0.54	0.50	0.35	0.23	0.28
8	0.25	0.39	0.50	0.51	0.47	0.33	0.18	0.27
9	0.22	0.37	0.48	0.47	0.45	0.30	0.13	0.30
10	0.20	0.34	0.44	0.45	0.42	0.27	0.09	0.30

DENVER, TRACK 3, AREA 4, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.85	0.85	0.91	0.92	0.83	0.87	0.90	0.87
2	0.68	0.68	0.79	0.82	0.65	0.71	0.77	0.69
3	0.59	0.55	0.72	0.76	0.55	0.60	0.68	0.60
4	0.54	0.47	0.65	0.72	0.50	0.52	0.60	0.54
5	0.51	0.41	0.58	0.68	0.45	0.45	0.53	0.50
6	0.49	0.34	0.54	0.65	0.41	0.40	0.48	0.46
7	0.46	0.28	0.51	0.62	0.38	0.37	0.45	0.41
8	0.43	0.24	0.49	0.59	0.36	0.35	0.41	0.33
9	0.40	0.22	0.48	0.57	0.33	0.33	0.36	0.26
10	0.39	0.20	0.48	0.56	0.32	0.32	0.32	0.23

DENVER, TRACK 3, AREA 5, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.94	0.93	0.94	0.95	0.88	0.89	0.88	0.91
2	0.87	0.86	0.86	0.88	0.75	0.77	0.72	0.81
3	0.83	0.82	0.80	0.84	0.67	0.70	0.62	0.76
4	0.80	0.81	0.75	0.81	0.62	0.66	0.54	0.72
5	0.78	0.79	0.72	0.81	0.58	0.62	0.50	0.70
6	0.76	0.76	0.69	0.80	0.55	0.59	0.45	0.67
7	0.74	0.74	0.68	0.79	0.52	0.56	0.42	0.67
8	0.72	0.73	0.66	0.78	0.51	0.53	0.41	0.68
9	0.70	0.73	0.65	0.77	0.49	0.49	0.39	0.66
10	0.69	0.72	0.64	0.75	0.46	0.47	0.37	0.64

ORIGINAL PAGE IS
OF POOR QUALITY

DENVER, TRACK 4, AREA 1, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.82	0.84	0.86	0.87	0.82	0.83	0.83	0.76
2	0.64	0.70	0.69	0.73	0.66	0.67	0.65	0.57
3	0.52	0.63	0.55	0.64	0.58	0.62	0.51	0.39
4	0.44	0.59	0.43	0.57	0.51	0.57	0.39	0.24
5	0.36	0.55	0.36	0.50	0.46	0.53	0.35	0.20
6	0.30	0.50	0.30	0.42	0.42	0.49	0.31	0.17
7	0.25	0.47	0.25	0.37	0.38	0.47	0.27	0.16
8	0.21	0.45	0.20	0.34	0.36	0.46	0.23	0.15
9	0.15	0.46	0.16	0.30	0.35	0.44	0.20	0.16
10	0.14	0.45	0.13	0.24	0.34	0.44	0.18	0.15

DENVER, TRACK 4, AREA 2, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.86	0.93	0.91	0.92	0.84	0.87	0.84	0.87
2	0.78	0.83	0.76	0.83	0.65	0.70	0.69	0.73
3	0.75	0.73	0.65	0.77	0.55	0.58	0.57	0.59
4	0.73	0.64	0.57	0.70	0.48	0.47	0.46	0.46
5	0.71	0.56	0.51	0.65	0.42	0.37	0.43	0.41
6	0.68	0.50	0.46	0.61	0.36	0.28	0.40	0.38
7	0.67	0.46	0.41	0.56	0.31	0.19	0.38	0.34
8	0.65	0.43	0.37	0.52	0.27	0.12	0.37	0.30
9	0.62	0.39	0.33	0.47	0.25	0.07	0.35	0.25
10	0.60	0.33	0.30	0.44	0.25	0.05	0.33	0.21

DENVER, TRACK 4, AREA 3, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.86	0.87	0.92	0.91	0.83	0.79	0.86	0.89
2	0.71	0.73	0.81	0.78	0.63	0.53	0.68	0.74
3	0.58	0.63	0.73	0.66	0.50	0.38	0.54	0.61
4	0.49	0.55	0.66	0.56	0.41	0.29	0.43	0.49
5	0.39	0.46	0.59	0.47	0.34	0.25	0.37	0.40
6	0.32	0.39	0.53	0.40	0.27	0.22	0.29	0.32
7	0.25	0.33	0.49	0.35	0.21	0.17	0.21	0.25
8	0.21	0.29	0.47	0.32	0.17	0.10	0.15	0.19
9	0.18	0.24	0.45	0.30	0.14	0.04	0.11	0.13
10	0.14	0.20	0.42	0.28	0.10	-0.02	0.09	0.08

ORIGINAL PAGE IS
OF POOR QUALITY

DENVER, TRACK 4, AREA 4, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.81	0.79	0.84	0.85	0.78	0.77	0.85	0.83
2	0.59	0.59	0.64	0.68	0.53	0.50	0.68	0.64
3	0.45	0.47	0.52	0.58	0.41	0.39	0.53	0.50
4	0.37	0.38	0.42	0.50	0.34	0.32	0.38	0.37
5	0.35	0.30	0.32	0.42	0.31	0.29	0.31	0.30
6	0.33	0.24	0.25	0.34	0.28	0.26	0.25	0.24
7	0.29	0.23	0.19	0.30	0.24	0.23	0.21	0.19
8	0.24	0.23	0.15	0.28	0.20	0.20	0.17	0.14
9	0.17	0.16	0.14	0.25	0.16	0.17	0.14	0.09
10	0.14	0.12	0.13	0.21	0.12	0.13	0.10	0.06

DENVER, TRACK 4, AREA 5, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.84	0.85	0.80	0.84	0.79	0.80	0.83	0.79
2	0.67	0.69	0.57	0.67	0.59	0.59	0.65	0.57
3	0.56	0.59	0.44	0.58	0.51	0.49	0.51	0.40
4	0.47	0.50	0.38	0.52	0.44	0.42	0.40	0.29
5	0.40	0.43	0.33	0.48	0.38	0.37	0.36	0.25
6	0.36	0.39	0.30	0.44	0.32	0.35	0.32	0.21
7	0.31	0.35	0.27	0.40	0.28	0.32	0.29	0.19
8	0.30	0.30	0.26	0.37	0.24	0.30	0.24	0.16
9	0.29	0.25	0.24	0.34	0.19	0.27	0.19	0.14
10	0.26	0.21	0.26	0.32	0.16	0.25	0.17	0.14

DENVER PACF

ORIGINAL PAGE IS
OF POOR QUALITY

DENVER, TRACK 1, AREA 1, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.94	0.92	0.96	0.97	0.95	0.93	0.89	0.88
2	-0.04	-0.08	-0.17	-0.12	-0.03	-0.13	-0.09	-0.26
3	0.15	0.17	0.26	0.21	0.19	0.26	0.24	0.21
4	0.07	0.13	0.11	0.10	-0.02	0.06	0.05	0.00
5	0.09	0.07	0.07	0.00	0.05	0.05	0.05	0.03
6	0.09	0.12	0.07	0.04	0.06	0.05	0.04	0.00
7	0.04	0.08	0.10	0.08	0.10	0.07	0.00	0.00
8	0.05	0.07	0.06	0.03	0.08	0.08	0.09	0.03
9	-0.02	0.04	0.02	0.03	0.02	0.04	0.02	0.01
10	0.12	0.06	0.12	0.13	0.04	0.01	0.04	0.01

DENVER, TRACK 1, AREA 2, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.93	0.93	0.94	0.90	0.93	0.94	0.88	0.91
2	-0.13	-0.22	-0.21	-0.36	-0.24	-0.29	-0.29	-0.14
3	0.20	0.08	0.18	0.38	0.15	0.23	0.09	0.18
4	-0.07	-0.09	0.02	-0.04	-0.04	-0.02	0.00	-0.04
5	-0.01	-0.07	0.04	0.08	0.08	0.12	0.04	0.08
6	0.02	0.04	0.01	0.14	0.02	0.02	0.07	-0.01
7	0.01	0.04	-0.01	0.01	0.04	0.01	0.00	0.01
8	-0.03	0.03	0.08	0.11	0.01	0.05	0.00	-0.04
9	-0.04	0.06	-0.02	-0.08	0.00	0.00	0.00	0.07
10	0.06	0.04	0.00	0.03	0.04	0.03	-0.01	0.00

DENVER, TRACK 1, AREA 3, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.88	0.94	0.93	0.93	0.90	0.92	0.88	0.90
2	-0.17	-0.15	-0.33	-0.33	-0.34	-0.20	-0.31	-0.29
3	0.28	0.25	0.27	0.24	0.19	0.21	0.22	0.13
4	-0.03	0.05	0.03	-0.04	0.03	0.00	-0.10	-0.05
5	0.14	0.04	0.03	0.14	0.04	0.10	0.03	0.06
6	0.08	0.00	-0.09	0.00	0.05	0.04	0.04	0.00
7	0.02	0.02	-0.03	0.02	-0.02	0.03	0.01	-0.03
8	0.05	0.06	0.06	0.01	0.00	-0.01	-0.05	-0.02
9	-0.09	0.00	-0.07	0.02	-0.05	0.02	0.00	-0.02
10	-0.01	0.06	0.11	-0.06	0.00	0.04	0.02	-0.02

ORIGINAL PAGE IS
OF POOR QUALITY

DENVER, TRACK 1, AREA 4, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.91	0.91	0.93	0.91	0.87	0.92	0.88	0.92
2	-0.18	-0.16	-0.20	-0.26	-0.19	-0.34	-0.24	-0.31
3	0.13	0.06	0.25	0.16	0.16	0.22	0.12	0.19
4	0.03	0.03	0.02	-0.05	0.03	0.05	0.02	0.03
5	0.03	0.05	0.11	0.09	0.10	0.07	0.00	0.01
6	0.09	0.00	0.04	-0.01	0.04	-0.03	0.01	0.01
7	0.08	0.05	-0.01	-0.05	-0.05	-0.04	0.05	0.00
8	0.01	0.05	0.04	-0.01	0.04	0.04	0.03	0.03
9	-0.03	-0.03	-0.06	-0.01	-0.02	-0.04	0.02	0.05
10	0.09	0.05	0.05	0.03	0.07	-0.02	-0.03	-0.01

DENVER, TRACK 1, AREA 5, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.91	0.89	0.92	0.94	0.91	0.92	0.93	0.93
2	-0.26	-0.20	-0.28	-0.35	-0.28	-0.23	-0.34	-0.32
3	0.18	0.12	0.19	0.12	0.24	0.08	0.13	0.12
4	-0.01	0.04	-0.10	0.06	-0.02	0.00	-0.08	-0.03
5	0.04	0.05	0.00	-0.03	0.05	0.01	0.03	0.01
6	-0.04	0.00	-0.02	0.06	0.03	0.05	-0.05	0.03
7	-0.01	-0.03	0.08	0.01	0.07	-0.03	-0.02	0.01
8	0.05	0.00	-0.01	-0.01	0.04	0.04	-0.03	0.01
9	0.06	0.01	-0.03	-0.09	0.02	-0.01	0.02	-0.03
10	0.08	0.01	0.03	0.01	0.00	0.03	0.03	0.05

DENVER, TRACK 2, AREA 1, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.92	0.93	0.92	0.92	0.90	0.81	0.86	0.82
2	0.03	0.02	-0.08	-0.10	-0.09	-0.11	0.03	-0.13
3	0.09	0.14	0.20	0.20	0.16	0.18	0.19	0.20
4	0.03	0.01	0.08	0.15	0.07	0.03	0.09	0.00
5	0.08	0.02	0.08	0.06	0.10	0.08	0.03	0.01
6	0.09	-0.01	0.08	0.09	0.07	0.04	0.00	0.07
7	0.03	0.04	0.06	0.03	0.11	-0.01	0.01	-0.04
8	0.11	0.02	0.05	0.07	0.05	-0.01	0.00	0.02
9	-0.01	0.00	0.02	0.02	0.03	0.08	0.03	0.08
10	0.12	0.02	0.02	0.04	0.06	0.03	0.08	0.00

ORIGINAL PAGE IS
OF POOR QUALITY

DENVER, TRACK 2, AREA 2, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.93	0.93	0.93	0.96	0.94	0.90	0.93	0.89
2	-0.17	-0.14	-0.28	-0.20	-0.28	-0.17	-0.29	-0.28
3	0.20	0.09	0.22	0.20	0.17	0.23	0.18	0.19
4	0.11	0.04	0.03	0.01	0.08	0.00	0.00	0.00
5	0.10	0.08	0.10	0.06	0.07	-0.03	0.08	0.06
6	0.06	0.08	0.04	0.12	0.03	-0.05	-0.01	0.00
7	0.08	0.04	0.06	0.00	0.06	-0.02	0.05	-0.03
8	0.11	0.13	0.01	0.08	0.07	0.06	0.02	0.06
9	0.01	-0.03	0.03	0.01	0.06	0.03	0.08	0.06
10	0.06	0.02	0.06	0.08	0.03	0.02	0.01	0.01

DENVER, TRACK 2, AREA 3, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.92	0.93	0.95	0.94	0.94	0.92	0.92	0.95
2	-0.24	-0.20	-0.23	-0.27	-0.10	-0.15	-0.32	-0.27
3	0.20	0.19	0.22	0.18	0.17	0.30	0.15	0.20
4	0.02	0.10	0.01	-0.01	0.03	0.06	-0.04	0.05
5	0.05	0.08	0.03	0.05	0.01	0.02	0.07	0.10
6	0.13	0.04	0.04	0.03	0.00	-0.06	0.05	0.03
7	0.08	0.08	0.10	0.10	0.00	0.01	0.03	0.04
8	0.05	0.06	0.04	0.08	0.04	0.03	-0.01	0.10
9	0.00	0.01	0.05	0.04	0.07	0.02	0.01	0.05
10	0.07	0.07	0.05	0.05	0.05	0.07	0.04	0.01

DENVER, TRACK 2, AREA 4, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.90	0.90	0.95	0.94	0.93	0.90	0.92	0.90
2	-0.12	-0.29	-0.36	-0.28	-0.16	-0.36	-0.30	-0.26
3	0.14	0.13	0.22	0.20	0.12	0.12	0.08	0.19
4	-0.09	0.02	0.01	-0.01	0.03	-0.05	0.02	-0.01
5	0.09	0.15	0.04	0.06	-0.01	0.01	0.09	0.03
6	0.01	0.07	0.00	0.06	0.08	0.07	0.03	-0.04
7	0.06	-0.03	0.12	0.07	0.07	0.08	0.03	-0.02
8	0.02	0.02	0.01	0.07	-0.02	-0.01	0.02	-0.04
9	0.02	0.11	-0.05	-0.04	0.01	0.02	-0.02	0.03
10	0.04	0.01	0.08	0.06	0.04	0.02	0.02	-0.05

DENVER, TRACK 2, AREA 5, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.88	0.91	0.95	0.94	0.93	0.88	0.91	0.85
2	-0.12	-0.21	-0.28	-0.24	-0.27	-0.41	-0.21	-0.32
3	0.22	0.13	0.27	0.23	0.15	0.13	0.14	0.12
4	0.00	0.05	0.03	0.04	0.05	0.01	-0.01	0.00
5	0.02	0.08	0.12	0.01	0.12	0.05	0.05	0.01
6	-0.04	-0.03	0.10	0.05	0.01	-0.02	-0.03	-0.01
7	0.07	0.00	-0.02	0.06	0.03	-0.04	-0.01	0.00
8	0.02	0.04	-0.07	-0.01	-0.03	-0.02	0.02	0.05
9	-0.05	-0.04	-0.01	-0.04	0.01	-0.02	0.05	0.01
10	0.03	0.03	0.03	-0.03	0.18	-0.01	-0.03	0.06

DENVER, TRACK 3, AREA 1, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.82	0.86	0.93	0.84	0.83	0.86	0.91	0.86
2	-0.09	-0.09	-0.15	-0.09	-0.01	-0.05	-0.14	-0.05
3	0.19	0.09	0.09	0.14	0.12	0.11	0.21	0.16
4	0.11	0.05	-0.03	0.01	-0.02	0.03	0.02	0.01
5	-0.03	0.01	0.00	0.00	-0.02	0.01	0.07	0.05
6	0.06	0.01	0.04	0.00	0.11	0.02	0.00	0.03
7	0.07	0.00	0.02	0.01	0.01	0.04	0.04	0.01
8	0.08	0.01	0.07	0.00	0.04	0.05	0.03	0.04
9	-0.05	-0.10	-0.03	0.03	-0.01	-0.02	0.03	0.00
10	0.02	0.04	0.08	0.00	0.00	0.03	0.02	0.02

DENVER, TRACK 3, AREA 2, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.81	0.84	0.87	0.86	0.88	0.85	0.87	0.87
2	-0.24	-0.22	-0.34	-0.28	-0.25	-0.16	-0.42	-0.33
3	0.10	0.10	0.12	0.16	0.04	0.21	0.22	0.14
4	-0.01	-0.03	-0.03	0.00	0.00	0.08	-0.05	-0.10
5	0.02	0.05	0.06	0.03	-0.02	0.04	0.07	0.02
6	0.06	0.04	-0.05	0.00	0.08	-0.05	0.02	0.00
7	0.05	0.06	-0.01	0.01	-0.01	0.08	-0.06	0.10
8	0.05	0.09	0.05	-0.02	0.05	0.03	0.02	-0.08
9	0.00	-0.01	-0.03	-0.02	-0.01	0.04	0.05	0.02
10	0.08	0.00	0.03	0.01	-0.01	0.00	-0.01	0.03

ORIGINAL PAGE IS
OF POOR QUALITY

DENVER, TRACK 3, AREA 3, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.85	0.88	0.90	0.93	0.91	0.89	0.87	0.84
2	-0.19	-0.21	-0.23	-0.33	-0.22	-0.23	-0.26	-0.19
3	0.06	0.06	0.15	0.22	0.16	0.09	0.14	0.20
4	-0.01	0.04	-0.01	0.00	-0.03	-0.04	-0.07	-0.12
5	0.03	0.05	0.10	0.07	0.02	0.04	0.01	0.09
6	0.07	0.08	0.09	0.02	0.04	0.03	-0.02	0.02
7	0.03	0.02	0.08	0.03	0.05	0.06	0.03	0.02
8	0.00	0.04	-0.01	0.01	0.03	0.04	-0.02	0.11
9	-0.03	-0.01	-0.02	-0.04	0.02	-0.04	-0.04	0.08
10	0.05	0.01	-0.03	0.10	0.00	0.01	0.00	-0.03

DENVER, TRACK 3, AREA 4, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.85	0.85	0.91	0.92	0.83	0.87	0.90	0.87
2	-0.15	-0.20	-0.19	-0.15	-0.15	-0.21	-0.17	-0.24
3	0.22	0.11	0.21	0.23	0.17	0.14	0.13	0.25
4	0.00	0.04	-0.12	0.01	0.06	0.00	-0.06	-0.01
5	0.12	0.00	0.08	0.05	0.03	-0.01	0.03	0.09
6	0.03	-0.03	0.05	0.02	0.03	0.08	0.07	0.01
7	0.02	-0.01	0.03	0.00	0.04	0.02	0.03	-0.06
8	0.04	0.06	0.07	0.08	0.02	0.05	-0.04	-0.11
9	-0.01	0.02	0.08	0.01	0.00	0.02	-0.07	0.03
10	0.10	-0.02	0.05	0.09	0.06	0.03	0.06	0.03

DENVER, TRACK 3, AREA 5, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.94	0.93	0.94	0.95	0.88	0.89	0.88	0.91
2	-0.13	-0.02	-0.22	-0.19	-0.12	-0.17	-0.24	-0.07
3	0.23	0.22	0.21	0.25	0.17	0.27	0.18	0.20
4	0.03	0.11	0.00	0.08	0.02	-0.02	0.00	0.07
5	0.08	0.04	0.07	0.17	0.10	0.08	0.10	0.07
6	0.01	0.04	0.07	0.03	-0.01	0.05	-0.05	0.05
7	0.05	0.03	0.07	0.06	0.08	0.03	0.11	0.14
8	0.00	0.08	0.02	0.06	0.05	-0.04	0.01	0.10
9	0.04	0.05	0.01	-0.02	-0.01	0.02	0.03	-0.04
10	0.08	0.04	0.12	0.04	0.03	0.05	0.00	-0.01

ORIGINAL PAGE IS
OF POOR QUALITY

DENVER, TRACK 4, AREA 1, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.82	0.84	0.86	0.87	0.82	0.83	0.83	0.76
2	-0.11	-0.04	-0.20	-0.09	-0.06	-0.06	-0.11	-0.03
3	0.07	0.17	0.04	0.10	0.18	0.25	0.01	-0.07
4	0.03	0.09	-0.01	0.00	-0.02	0.00	-0.03	-0.07
5	-0.03	0.02	0.06	0.00	0.06	0.07	0.18	0.15
6	0.03	0.00	-0.01	-0.04	0.02	0.04	-0.04	0.02
7	0.00	0.05	0.00	0.05	0.02	0.04	-0.01	0.00
8	-0.03	0.06	-0.02	0.04	0.06	0.07	-0.01	0.01
9	-0.03	0.09	-0.01	-0.07	0.01	0.01	0.05	0.07
10	0.08	0.02	0.03	-0.05	0.06	0.08	-0.03	0.01

DENVER, TRACK 4, AREA 2, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.86	0.93	0.91	0.92	0.84	0.87	0.84	0.87
2	0.16	-0.30	-0.32	-0.03	-0.16	-0.22	-0.01	-0.08
3	0.20	0.04	0.17	0.05	0.16	0.13	-0.03	-0.08
4	0.12	-0.03	0.00	-0.01	0.01	-0.09	-0.03	-0.05
5	0.06	0.01	0.04	0.03	0.03	-0.02	0.22	0.22
6	0.06	0.09	0.00	0.03	-0.04	-0.05	-0.01	0.00
7	0.04	0.06	-0.02	-0.03	0.02	-0.04	0.05	-0.04
8	0.01	-0.03	0.03	0.01	0.03	-0.01	0.01	-0.05
9	0.00	-0.10	0.01	-0.06	0.01	0.04	0.06	0.02
10	0.01	-0.06	0.02	0.05	0.11	0.01	0.00	0.04

DENVER, TRACK 4, AREA 3, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.86	0.87	0.92	0.91	0.83	0.79	0.86	0.89
2	-0.13	-0.12	-0.21	-0.32	-0.21	-0.25	-0.26	-0.22
3	0.04	0.06	0.21	0.09	0.15	0.16	0.09	0.02
4	0.01	0.02	-0.10	-0.04	0.00	-0.02	0.01	-0.06
5	-0.06	-0.04	-0.04	0.01	-0.02	0.09	0.08	0.05
6	0.02	-0.01	0.07	0.05	0.00	-0.02	-0.15	-0.06
7	-0.04	0.02	0.05	-0.01	-0.02	-0.02	0.00	0.01
8	0.09	0.03	0.12	0.10	0.04	-0.06	0.00	-0.06
9	-0.03	-0.08	-0.09	-0.01	-0.03	-0.04	0.05	-0.02
10	-0.02	0.04	0.05	0.00	-0.02	-0.04	-0.04	-0.01

DENVER, TRACK 4, AREA 4, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.81	0.79	0.84	0.85	0.78	0.77	0.85	0.83
2	-0.18	-0.09	-0.20	-0.16	-0.20	-0.21	-0.16	-0.16
3	0.10	0.09	0.17	0.17	0.17	0.21	-0.02	0.02
4	0.06	0.02	-0.10	-0.02	0.00	-0.04	-0.09	-0.05
5	0.08	-0.03	0.00	-0.04	0.11	0.10	0.15	0.11
6	0.03	0.02	0.01	0.00	-0.03	0.00	-0.02	-0.04
7	-0.01	0.07	-0.03	0.08	0.03	0.03	0.01	-0.02
8	-0.03	0.05	0.05	0.01	0.00	0.00	-0.05	-0.01
9	-0.04	-0.14	0.01	-0.03	-0.03	-0.02	0.03	-0.02
10	0.03	0.05	0.04	0.01	-0.01	-0.01	-0.04	0.00

DENVER, TRACK 4, AREA 5, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.84	0.85	0.80	0.84	0.79	0.80	0.83	0.79
2	-0.10	-0.08	-0.22	-0.15	-0.08	-0.16	-0.12	-0.16
3	0.09	0.09	0.16	0.20	0.19	0.21	0.03	0.03
4	-0.04	-0.03	0.06	0.02	-0.03	-0.05	-0.01	-0.01
5	0.08	0.04	-0.01	0.07	0.05	0.10	0.15	0.13
6	0.02	0.05	0.08	0.01	-0.03	0.03	-0.05	-0.05
7	-0.01	-0.02	0.01	0.02	0.04	0.02	0.04	0.04
8	0.11	-0.01	0.06	0.03	-0.03	0.03	-0.04	-0.01
9	0.00	-0.05	-0.01	-0.01	-0.01	0.01	-0.01	0.04
10	-0.04	0.04	0.14	0.03	0.02	0.03	0.03	0.03

RICHMOND ACF

ORIGINAL PAGE IS
OF POOR QUALITY

RICHMOND, TRACK 1, AREA 1, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.83	0.82	0.87	0.91	0.90	0.91	0.87	0.91
2	0.64	0.65	0.71	0.79	0.76	0.79	0.69	0.79
3	0.49	0.52	0.58	0.70	0.66	0.72	0.53	0.70
4	0.36	0.44	0.51	0.64	0.60	0.67	0.41	0.64
5	0.26	0.38	0.46	0.59	0.55	0.63	0.33	0.59
6	0.17	0.34	0.41	0.54	0.51	0.59	0.28	0.56
7	0.12	0.29	0.36	0.51	0.48	0.55	0.24	0.53
8	0.11	0.26	0.32	0.48	0.46	0.52	0.20	0.51
9	0.12	0.21	0.28	0.44	0.44	0.49	0.15	0.50
10	0.15	0.19	0.25	0.40	0.41	0.48	0.10	0.48

RICHMOND, TRACK 1, AREA 2, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.79	0.77	0.83	0.84	0.79	0.83	0.76	0.77
2	0.63	0.57	0.62	0.66	0.55	0.60	0.53	0.49
3	0.52	0.46	0.45	0.54	0.40	0.45	0.44	0.37
4	0.44	0.39	0.32	0.44	0.33	0.33	0.37	0.28
5	0.38	0.36	0.23	0.37	0.30	0.24	0.33	0.20
6	0.35	0.35	0.19	0.30	0.29	0.17	0.28	0.17
7	0.34	0.35	0.16	0.25	0.28	0.13	0.22	0.16
8	0.34	0.37	0.15	0.21	0.25	0.13	0.16	0.13
9	0.27	0.30	0.12	0.18	0.20	0.13	0.09	0.11
10	0.24	0.25	0.12	0.14	0.14	0.14	0.04	0.11

RICHMOND, TRACK 1, AREA 3, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.79	0.83	0.85	0.86	0.84	0.86	0.78	0.80
2	0.58	0.64	0.65	0.67	0.68	0.70	0.55	0.64
3	0.43	0.51	0.49	0.56	0.58	0.58	0.45	0.55
4	0.33	0.41	0.37	0.49	0.49	0.49	0.38	0.45
5	0.24	0.32	0.29	0.41	0.44	0.42	0.31	0.38
6	0.18	0.25	0.23	0.32	0.41	0.35	0.25	0.31
7	0.15	0.19	0.19	0.25	0.39	0.29	0.23	0.22
8	0.17	0.15	0.16	0.22	0.37	0.23	0.22	0.16
9	0.17	0.11	0.13	0.18	0.36	0.18	0.20	0.12
10	0.20	0.06	0.11	0.13	0.34	0.14	0.17	0.05

ORIGINAL PAGE IS
OF POOR QUALITY

RICHMOND, TRACK 1, AREA 4, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.65	0.77	0.81	0.81	0.84	0.80	0.73	0.74
2	0.42	0.59	0.58	0.58	0.65	0.59	0.45	0.45
3	0.33	0.52	0.42	0.44	0.52	0.45	0.31	0.31
4	0.29	0.48	0.32	0.35	0.45	0.36	0.29	0.24
5	0.28	0.42	0.27	0.31	0.41	0.30	0.29	0.19
6	0.24	0.37	0.25	0.30	0.37	0.23	0.30	0.14
7	0.27	0.38	0.23	0.31	0.35	0.21	0.28	0.12
8	0.32	0.39	0.23	0.33	0.32	0.21	0.22	0.10
9	0.29	0.32	0.23	0.31	0.30	0.20	0.15	0.09
10	0.26	0.29	0.21	0.28	0.28	0.21	0.12	0.08

RICHMOND, TRACK 1, AREA 5, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.78	0.78	0.82	0.79	0.74	0.80	0.73	0.76
2	0.51	0.46	0.54	0.52	0.46	0.56	0.46	0.49
3	0.35	0.28	0.35	0.39	0.33	0.44	0.32	0.34
4	0.25	0.24	0.23	0.31	0.27	0.37	0.26	0.24
5	0.20	0.24	0.16	0.25	0.24	0.28	0.19	0.19
6	0.16	0.22	0.11	0.19	0.23	0.20	0.15	0.16
7	0.13	0.19	0.10	0.13	0.20	0.16	0.15	0.13
8	0.12	0.16	0.12	0.08	0.17	0.14	0.15	0.13
9	0.06	0.09	0.16	0.06	0.13	0.14	0.13	0.14
10	0.02	0.03	0.17	0.07	0.12	0.13	0.11	0.11

RICHMOND, TRACK 2, AREA 1, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.83	0.80	0.86	0.84	0.83	0.83	0.75	0.74
2	0.65	0.54	0.65	0.63	0.64	0.61	0.54	0.47
3	0.52	0.34	0.48	0.50	0.51	0.43	0.43	0.33
4	0.42	0.20	0.36	0.41	0.40	0.27	0.34	0.22
5	0.34	0.10	0.28	0.34	0.32	0.16	0.28	0.14
6	0.27	0.02	0.22	0.27	0.30	0.08	0.23	0.11
7	0.20	-0.01	0.19	0.22	0.26	0.04	0.19	0.09
8	0.17	0.01	0.17	0.18	0.21	0.02	0.18	0.05
9	0.14	0.01	0.16	0.14	0.19	0.01	0.19	0.01
10	0.12	0.01	0.15	0.10	0.18	-0.01	0.21	0.00

RICHMOND, TRACK 2, AREA 2, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.89	0.83	0.83	0.87	0.85	0.84	0.75	0.76
2	0.73	0.59	0.62	0.66	0.66	0.67	0.51	0.53
3	0.61	0.41	0.49	0.50	0.53	0.57	0.42	0.39
4	0.51	0.28	0.40	0.39	0.40	0.48	0.37	0.27
5	0.43	0.19	0.33	0.31	0.29	0.39	0.33	0.18
6	0.36	0.13	0.26	0.26	0.18	0.31	0.29	0.14
7	0.30	0.09	0.21	0.21	0.08	0.24	0.23	0.07
8	0.26	0.07	0.17	0.17	0.02	0.19	0.17	0.00
9	0.21	0.03	0.11	0.12	-0.05	0.14	0.13	-0.02
10	0.17	-0.01	0.08	0.09	-0.08	0.12	0.10	-0.03

RICHMOND, TRACK 2, AREA 3, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.68	0.77	0.80	0.88	0.79	0.79	0.74	0.76
2	0.44	0.57	0.54	0.70	0.60	0.59	0.50	0.51
3	0.34	0.43	0.37	0.57	0.47	0.51	0.39	0.38
4	0.28	0.34	0.26	0.51	0.38	0.46	0.34	0.29
5	0.23	0.25	0.21	0.47	0.34	0.41	0.30	0.25
6	0.22	0.19	0.18	0.45	0.31	0.38	0.29	0.23
7	0.22	0.14	0.18	0.43	0.33	0.33	0.25	0.18
8	0.24	0.13	0.18	0.39	0.33	0.31	0.22	0.18
9	0.18	0.10	0.15	0.32	0.31	0.29	0.23	0.21
10	0.15	0.08	0.12	0.25	0.29	0.27	0.25	0.23

RICHMOND, TRACK 2, AREA 4, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.88	0.76	0.85	0.86	0.82	0.79	0.69	0.78
2	0.75	0.52	0.63	0.65	0.65	0.57	0.43	0.52
3	0.67	0.39	0.48	0.50	0.53	0.44	0.30	0.33
4	0.61	0.33	0.38	0.39	0.44	0.35	0.20	0.22
5	0.55	0.28	0.32	0.31	0.39	0.26	0.14	0.18
6	0.50	0.21	0.28	0.27	0.35	0.22	0.13	0.15
7	0.44	0.13	0.24	0.26	0.33	0.18	0.14	0.13
8	0.40	0.06	0.21	0.26	0.30	0.16	0.12	0.13
9	0.36	0.01	0.19	0.26	0.26	0.09	0.11	0.15
10	0.30	0.01	0.18	0.25	0.24	0.04	0.10	0.18

RICHMOND, TRACK 2, AREA 5, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.80	0.87	0.86	0.84	0.81	0.81	0.73	0.61
2	0.59	0.71	0.68	0.62	0.62	0.61	0.49	0.31
3	0.49	0.58	0.57	0.44	0.53	0.49	0.36	0.21
4	0.41	0.49	0.52	0.33	0.46	0.43	0.28	0.17
5	0.33	0.41	0.49	0.26	0.41	0.39	0.22	0.20
6	0.25	0.36	0.44	0.21	0.37	0.36	0.15	0.21
7	0.19	0.31	0.38	0.17	0.33	0.33	0.14	0.17
8	0.17	0.27	0.33	0.17	0.30	0.32	0.14	0.15
9	0.14	0.25	0.29	0.18	0.26	0.30	0.11	0.12
10	0.12	0.23	0.26	0.18	0.22	0.28	0.07	0.11

RICHMOND, TRACK 3, AREA 1, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.89	0.85	0.89	0.90	0.90	0.91	0.85	0.94
2	0.75	0.70	0.73	0.73	0.76	0.79	0.69	0.89
3	0.62	0.59	0.59	0.59	0.66	0.70	0.60	0.85
4	0.53	0.48	0.48	0.47	0.57	0.64	0.53	0.82
5	0.45	0.41	0.39	0.38	0.49	0.59	0.47	0.79
6	0.39	0.36	0.31	0.32	0.43	0.55	0.40	0.76
7	0.33	0.35	0.25	0.26	0.37	0.52	0.35	0.73
8	0.26	0.35	0.20	0.21	0.32	0.49	0.30	0.71
9	0.19	0.33	0.14	0.15	0.28	0.46	0.23	0.69
10	0.12	0.30	0.08	0.11	0.25	0.44	0.16	0.67

RICHMOND, TRACK 3, AREA 2, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.88	0.89	0.94	0.86	0.86	0.94	0.82	0.91
2	0.71	0.76	0.85	0.66	0.69	0.86	0.63	0.77
3	0.57	0.66	0.76	0.50	0.55	0.80	0.52	0.66
4	0.46	0.58	0.68	0.38	0.45	0.74	0.45	0.57
5	0.37	0.51	0.60	0.30	0.38	0.69	0.42	0.49
6	0.28	0.45	0.52	0.26	0.31	0.65	0.40	0.45
7	0.23	0.41	0.46	0.23	0.23	0.61	0.36	0.42
8	0.20	0.38	0.41	0.22	0.17	0.59	0.29	0.40
9	0.16	0.36	0.36	0.22	0.11	0.56	0.23	0.39
10	0.14	0.34	0.32	0.23	0.06	0.53	0.20	0.37

ORIGINAL PAGE IS
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RICHMOND, TRACK 3, AREA 3, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.83	0.82	0.88	0.84	0.96	0.88	0.94	0.98
2	0.64	0.61	0.73	0.64	0.91	0.77	0.88	0.95
3	0.50	0.48	0.62	0.50	0.89	0.70	0.82	0.92
4	0.39	0.38	0.54	0.41	0.87	0.64	0.77	0.90
5	0.31	0.30	0.47	0.34	0.86	0.59	0.73	0.87
6	0.24	0.24	0.41	0.28	0.85	0.55	0.68	0.85
7	0.17	0.19	0.35	0.23	0.84	0.51	0.64	0.82
8	0.12	0.17	0.33	0.18	0.83	0.49	0.59	0.80
9	0.08	0.12	0.31	0.13	0.81	0.46	0.56	0.77
10	0.03	0.08	0.31	0.09	0.79	0.46	0.53	0.74

RICHMOND, TRACK 3, AREA 4, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.86	0.91	0.86	0.91	0.82	0.83	0.81	0.82
2	0.70	0.76	0.63	0.77	0.62	0.64	0.61	0.62
3	0.55	0.62	0.45	0.63	0.50	0.50	0.48	0.51
4	0.42	0.51	0.34	0.52	0.41	0.37	0.36	0.41
5	0.33	0.43	0.28	0.43	0.33	0.29	0.27	0.35
6	0.25	0.37	0.25	0.36	0.26	0.26	0.21	0.31
7	0.19	0.31	0.23	0.32	0.20	0.23	0.16	0.30
8	0.15	0.27	0.21	0.29	0.19	0.23	0.10	0.29
9	0.08	0.22	0.19	0.27	0.16	0.22	0.08	0.28
10	0.03	0.19	0.17	0.25	0.15	0.22	0.08	0.27

RICHMOND, TRACK 3, AREA 5, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.86	0.83	0.89	0.87	0.84	0.87	0.86	0.89
2	0.66	0.59	0.71	0.65	0.63	0.71	0.73	0.77
3	0.51	0.40	0.56	0.48	0.46	0.59	0.65	0.69
4	0.39	0.29	0.45	0.38	0.33	0.50	0.57	0.65
5	0.30	0.22	0.37	0.32	0.25	0.42	0.51	0.64
6	0.24	0.16	0.33	0.27	0.21	0.35	0.48	0.61
7	0.20	0.10	0.31	0.23	0.18	0.32	0.45	0.59
8	0.18	0.04	0.30	0.20	0.16	0.29	0.42	0.55
9	0.14	-0.01	0.29	0.18	0.13	0.26	0.40	0.51
10	0.12	-0.03	0.28	0.17	0.12	0.24	0.38	0.48

ORIGINAL PAGE IS
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RICHMOND, TRACK 4, AREA 1, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.90	0.86	0.94	0.92	0.98	0.96	0.97	0.98
2	0.80	0.70	0.86	0.80	0.95	0.90	0.93	0.96
3	0.73	0.56	0.79	0.71	0.92	0.86	0.89	0.94
4	0.67	0.48	0.74	0.66	0.90	0.81	0.85	0.93
5	0.61	0.43	0.70	0.62	0.89	0.78	0.82	0.92
6	0.55	0.41	0.66	0.60	0.88	0.75	0.80	0.91
7	0.51	0.38	0.64	0.60	0.87	0.74	0.79	0.91
8	0.47	0.35	0.63	0.59	0.86	0.72	0.78	0.91
9	0.43	0.30	0.63	0.57	0.85	0.70	0.78	0.91
10	0.39	0.26	0.63	0.55	0.85	0.69	0.78	0.90

RICHMOND, TRACK 4, AREA 2, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.81	0.81	0.92	0.89	0.97	0.92	0.97	0.97
2	0.64	0.65	0.80	0.72	0.93	0.84	0.92	0.94
3	0.53	0.52	0.69	0.57	0.89	0.79	0.89	0.91
4	0.47	0.42	0.60	0.47	0.88	0.75	0.87	0.88
5	0.40	0.35	0.51	0.39	0.86	0.71	0.85	0.86
6	0.33	0.31	0.45	0.36	0.84	0.69	0.84	0.85
7	0.28	0.28	0.42	0.35	0.83	0.67	0.83	0.84
8	0.26	0.24	0.39	0.34	0.83	0.66	0.82	0.83
9	0.23	0.17	0.36	0.30	0.81	0.65	0.81	0.82
10	0.21	0.11	0.34	0.26	0.80	0.62	0.80	0.81

RICHMOND, TRACK 4, AREA 3, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.80	0.81	0.87	0.87	0.96	0.96	0.96	0.95
2	0.66	0.61	0.72	0.69	0.90	0.92	0.91	0.89
3	0.59	0.48	0.65	0.56	0.86	0.89	0.88	0.84
4	0.52	0.39	0.61	0.50	0.83	0.86	0.85	0.80
5	0.47	0.28	0.55	0.47	0.80	0.84	0.83	0.78
6	0.43	0.20	0.49	0.47	0.76	0.82	0.80	0.74
7	0.41	0.17	0.46	0.48	0.74	0.80	0.78	0.72
8	0.41	0.16	0.45	0.48	0.71	0.78	0.76	0.71
9	0.33	0.14	0.39	0.45	0.69	0.77	0.75	0.71
10	0.26	0.14	0.33	0.44	0.67	0.75	0.73	0.71

ORIGINAL PAGE IS
OF POOR QUALITY

RICHMOND, TRACK 4, AREA 4, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.84	0.85	0.87	0.88	0.83	0.80	0.87	0.86
2	0.64	0.68	0.66	0.69	0.65	0.60	0.71	0.70
3	0.50	0.55	0.50	0.52	0.55	0.49	0.60	0.58
4	0.40	0.45	0.40	0.40	0.47	0.43	0.53	0.49
5	0.33	0.39	0.31	0.33	0.40	0.38	0.50	0.44
6	0.29	0.35	0.23	0.29	0.33	0.33	0.49	0.41
7	0.25	0.34	0.18	0.25	0.28	0.30	0.48	0.39
8	0.21	0.32	0.16	0.21	0.25	0.28	0.45	0.36
9	0.18	0.28	0.15	0.18	0.19	0.25	0.42	0.34
10	0.15	0.24	0.16	0.16	0.15	0.25	0.40	0.31

RICHMOND, TRACK 4, AREA 5, ACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.97	0.95	0.97	0.95	0.93	0.94	0.93	0.89
2	0.95	0.90	0.94	0.88	0.88	0.91	0.86	0.79
3	0.94	0.87	0.91	0.83	0.86	0.89	0.82	0.73
4	0.93	0.84	0.88	0.79	0.85	0.88	0.78	0.67
5	0.92	0.81	0.87	0.75	0.84	0.87	0.77	0.66
6	0.91	0.79	0.85	0.72	0.83	0.86	0.76	0.64
7	0.91	0.78	0.83	0.69	0.82	0.85	0.76	0.62
8	0.90	0.77	0.82	0.67	0.81	0.84	0.75	0.60
9	0.89	0.76	0.80	0.64	0.80	0.84	0.74	0.59
10	0.89	0.75	0.78	0.62	0.80	0.82	0.73	0.58

RICHMOND PACF

RICHMOND, TRACK 1, AREA 1, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

RICHMOND, TRACK 1, AREA 2, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

RICHMOND, TRACK 1, AREA 3, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

ORIGINAL PAGE IS
OF POOR QUALITY

RICHMOND, TRACK 1, AREA 4, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

RICHMOND, TRACK 1, AREA 5, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

RICHMOND, TRACK 2, AREA 1, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

RICHMOND, TRACK 2, AREA 2, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

RICHMOND, TRACK 2, AREA 3, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

RICHMOND, TRACK 2, AREA 4, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

ORIGINAL PAGE IS
OF POOR QUALITY

RICHMOND, TRACK 2, AREA 5, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

RICHMOND, TRACK 3, AREA 1, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

RICHMOND, TRACK 3, AREA 2, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

RICHMOND, TRACK 3, AREA 3, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

RICHMOND, TRACK 3, AREA 4, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0,00	0.00	0.00	0.00	0.00	0.00	0.00

RICHMOND, TRACK 3, AREA 5, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

ORIGINAL PAGE IS
OF POOR QUALITY

RICHMOND, TRACK 4, AREA 1, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

RICHMOND, TRACK 4, AREA 2, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

RICHMOND, TRACK 4, AREA 3, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

ORIGINAL PAGE IS
OF POOR QUALITY

RICHMOND, TRACK 4, AREA 4, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

RICHMOND, TRACK 4, AREA 5, PACF

CHANNEL	1		2		3		4	
REPLICATE	1	2	1	2	1	2	1	2
LAG								
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix C

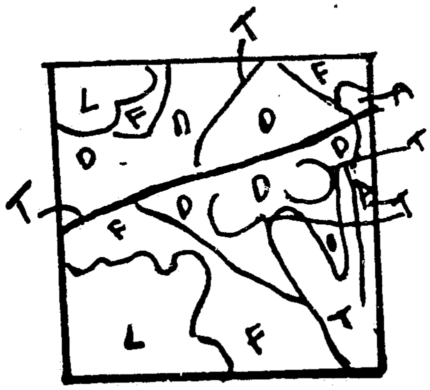
Original Photo-Interpreted Overlays

These data are the basis of the accuracy evaluation. They were provided by Mr. David Toll of NASA Goddard Space Flight Center. They are in two groups:

PHASE ONE

ORIGINAL PAGE IS
OF POOR QUALITY

SEVEN PINES



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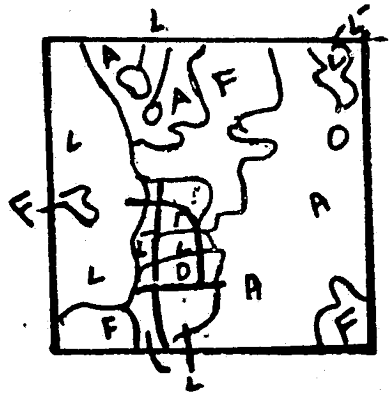

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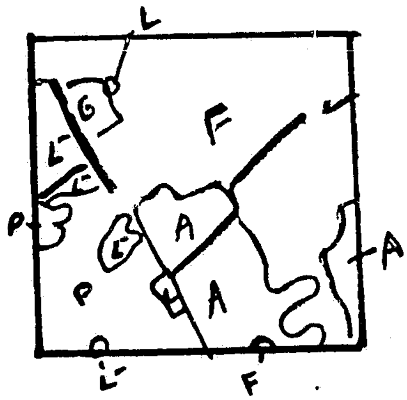

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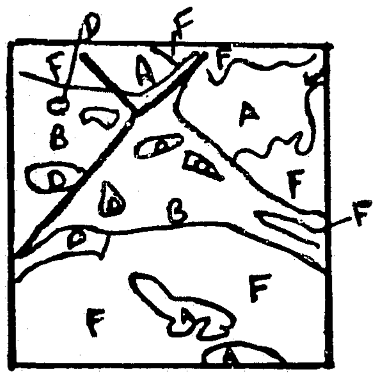

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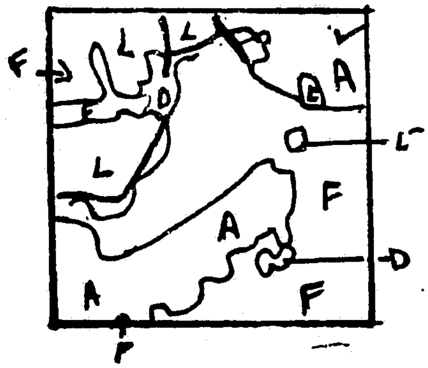

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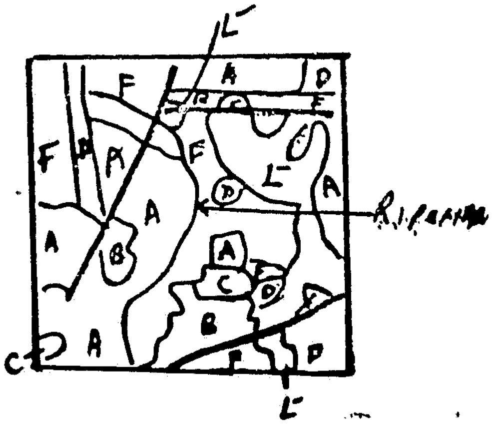
SEVEN PINES (continued)



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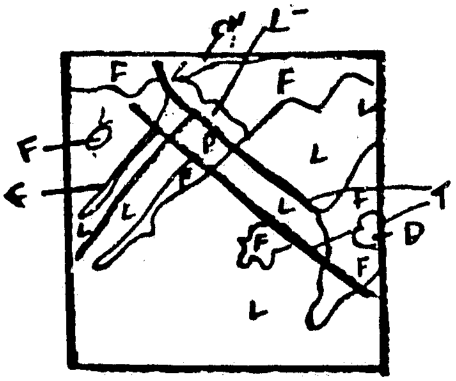

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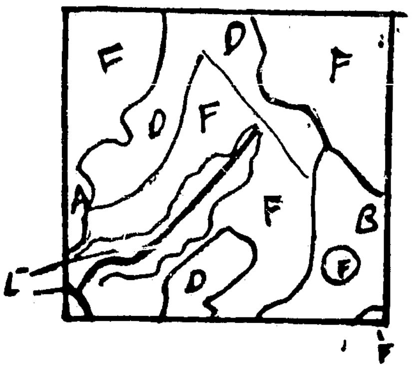

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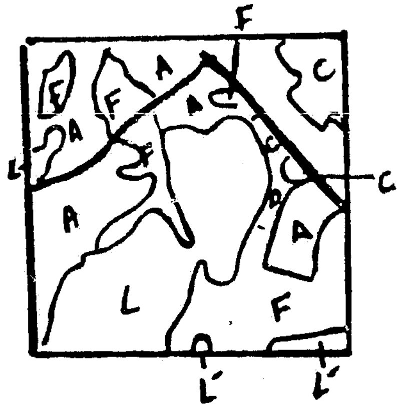

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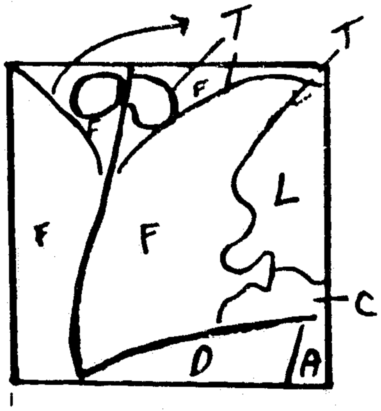

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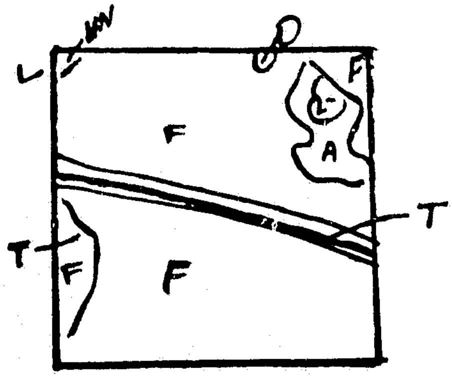

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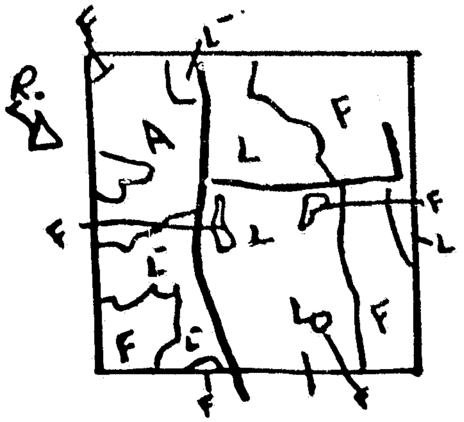
CHESTERFIELD



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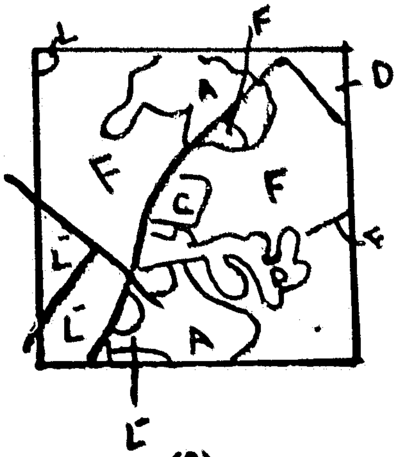

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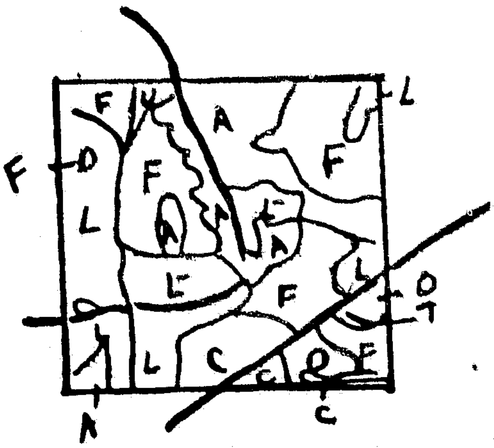

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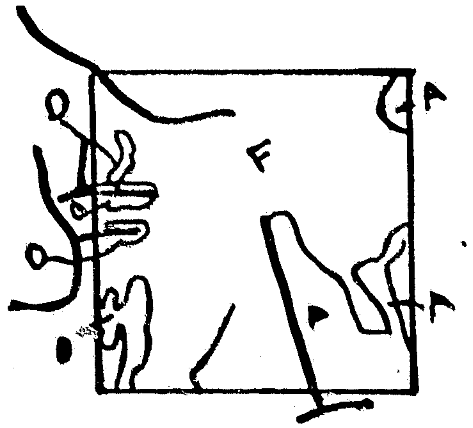

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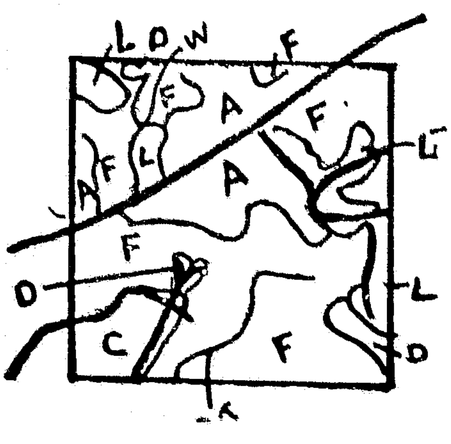

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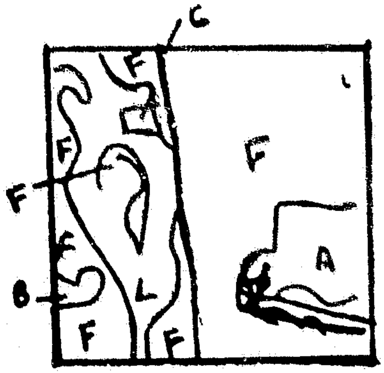

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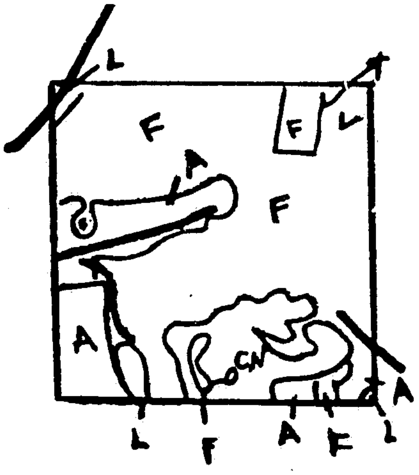

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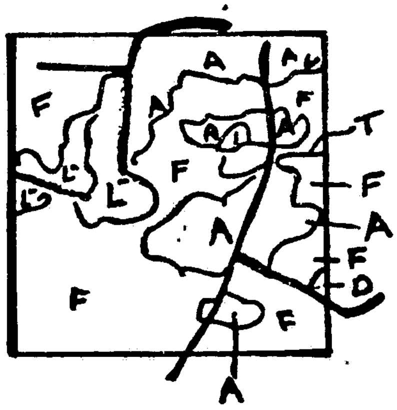

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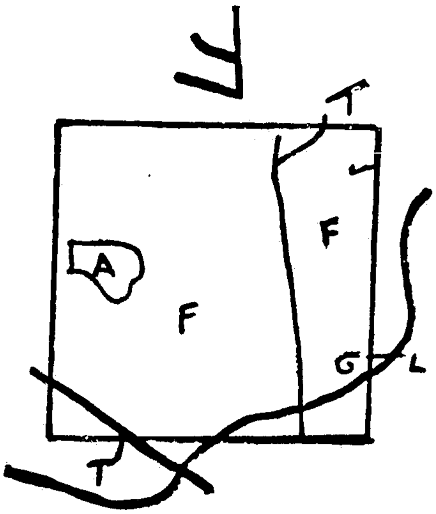

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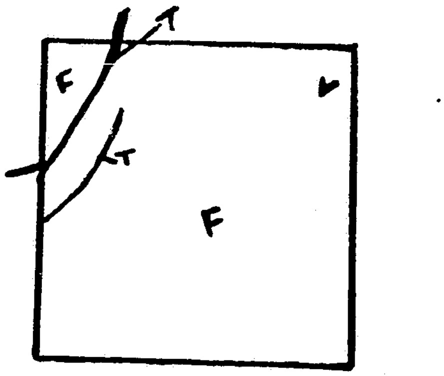

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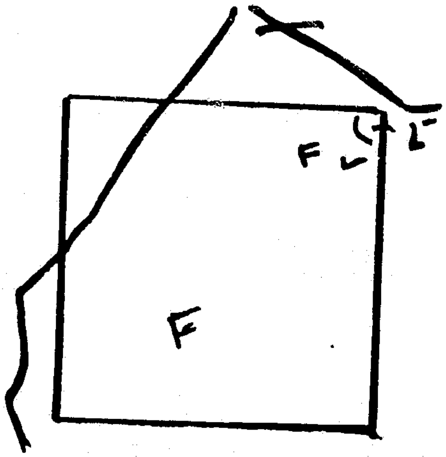

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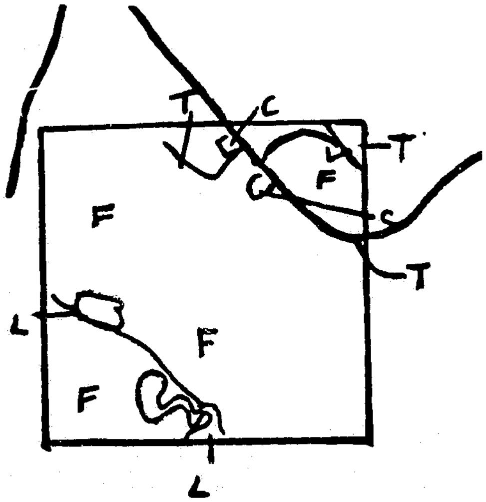

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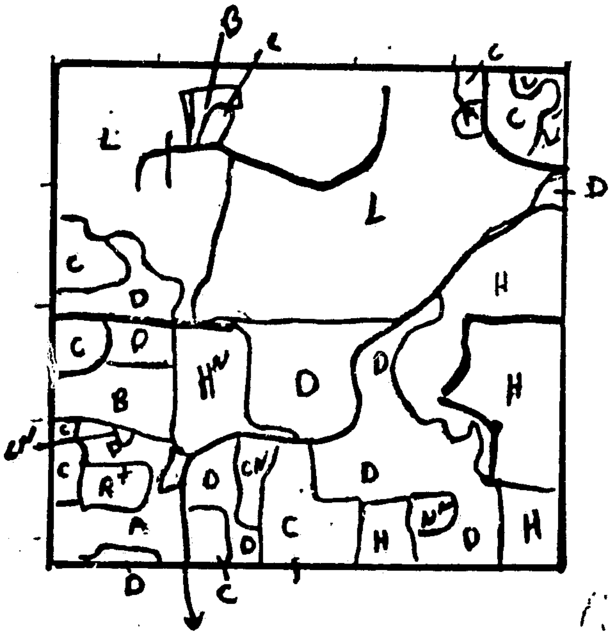
FITZSIMMONS



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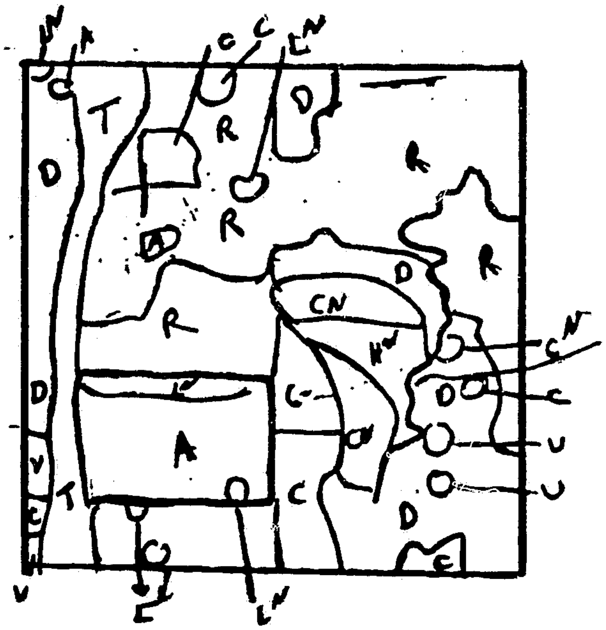

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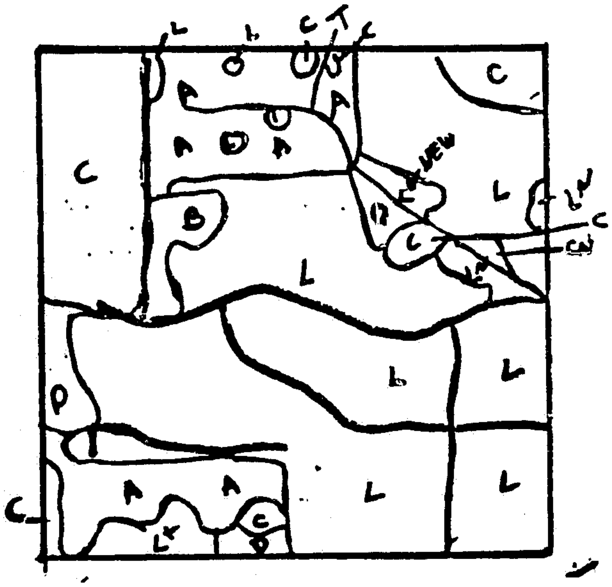

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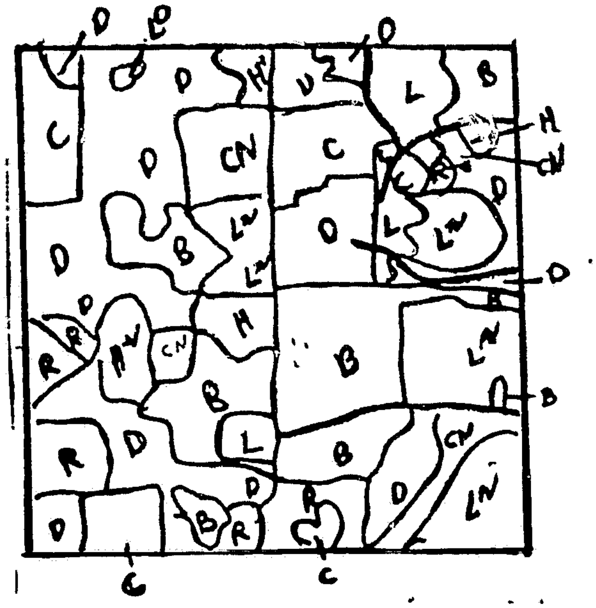

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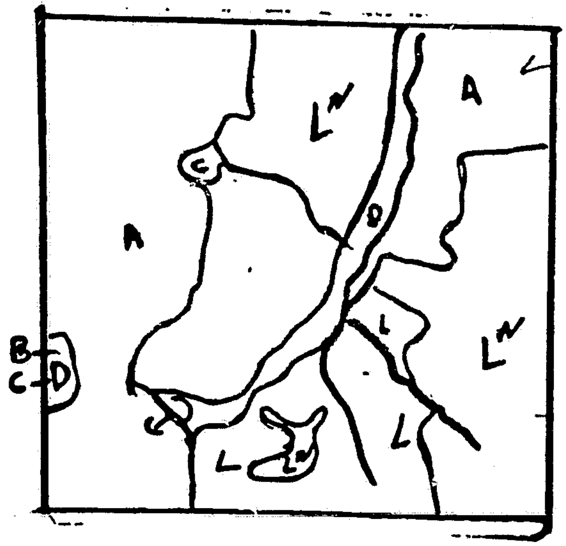

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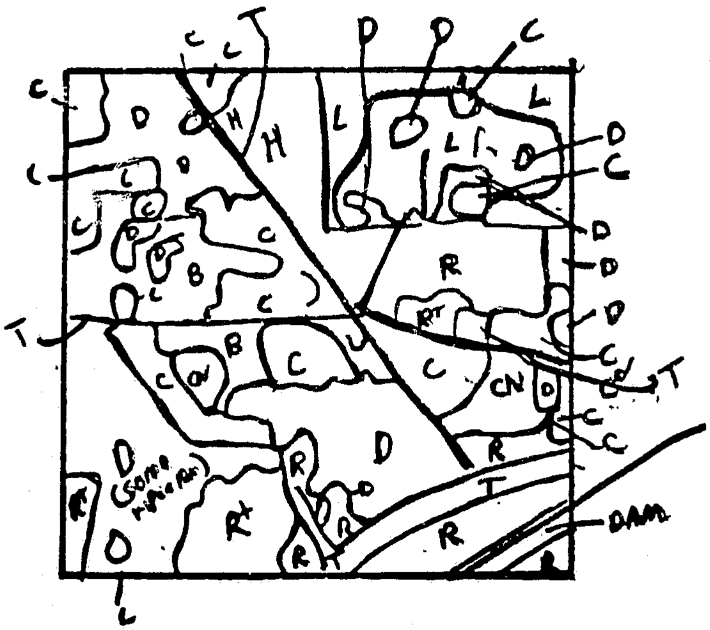

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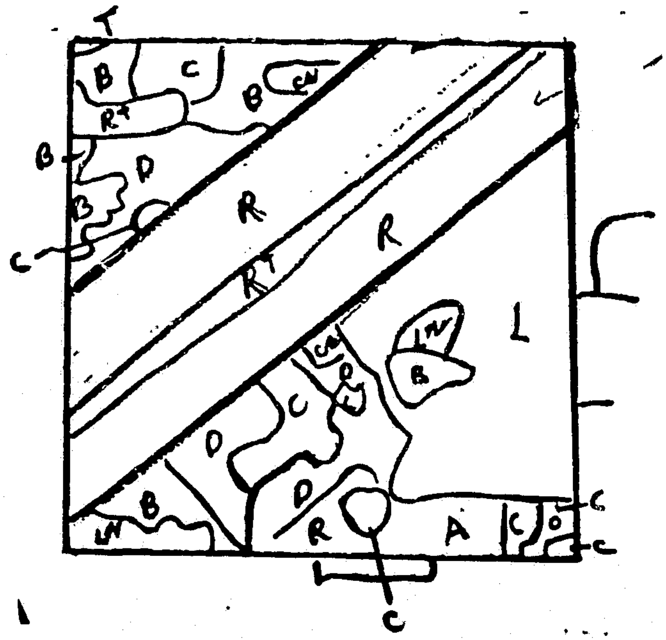

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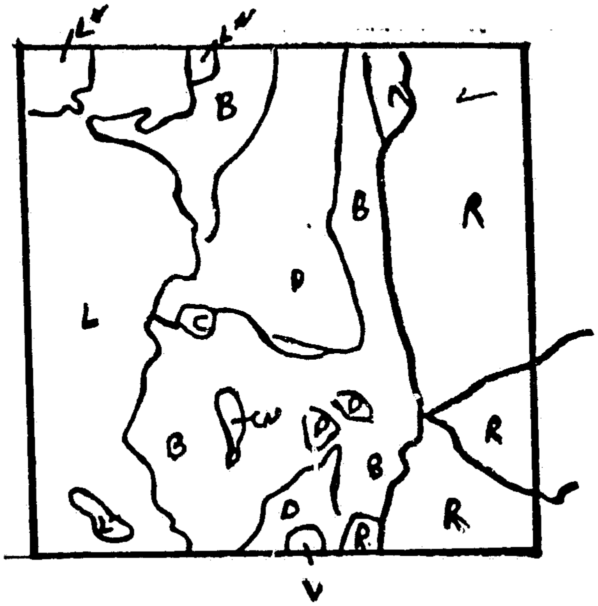

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PHASE TWO

HIGHLAND RANCH

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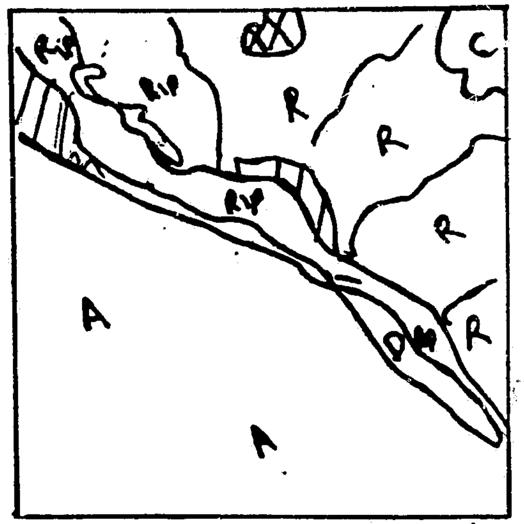

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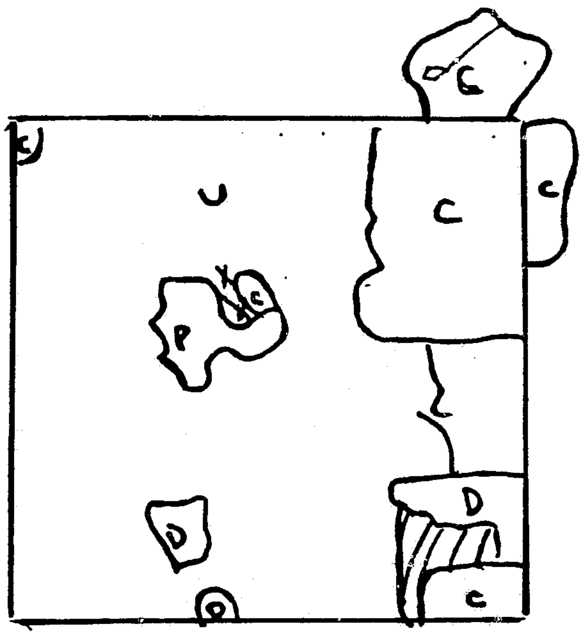

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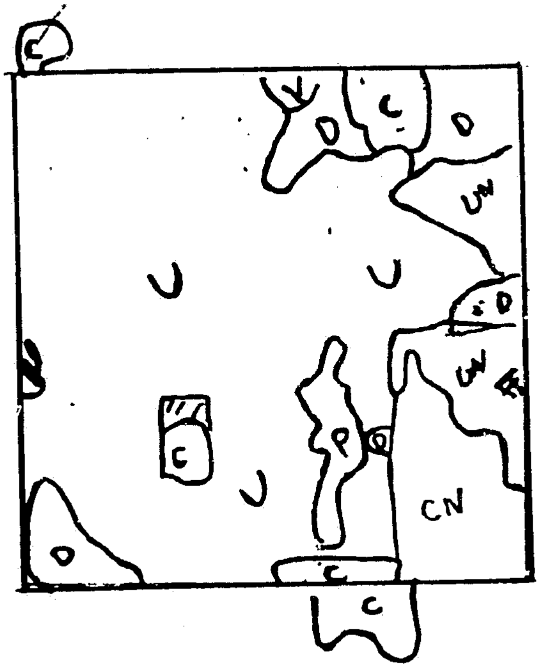

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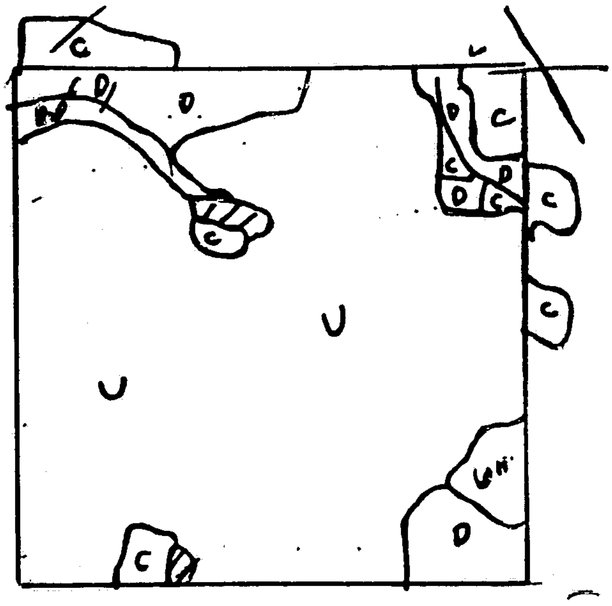

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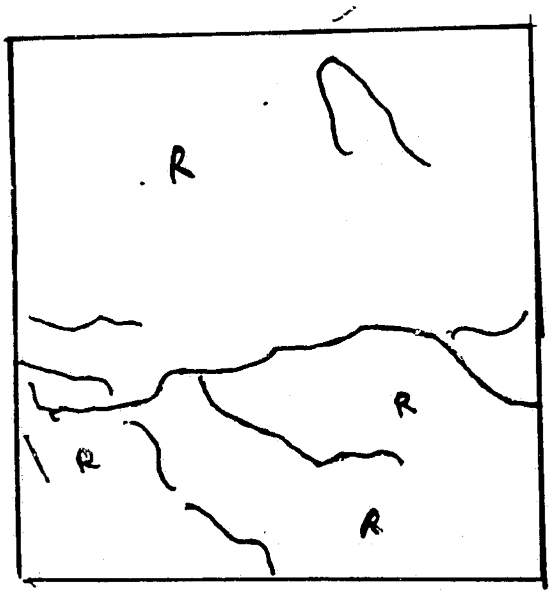

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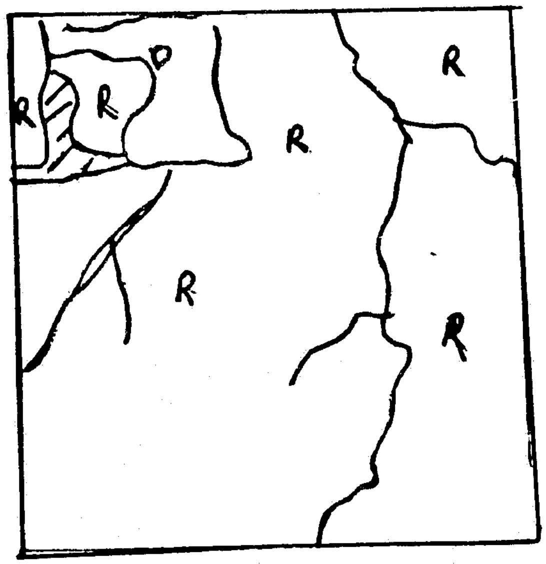

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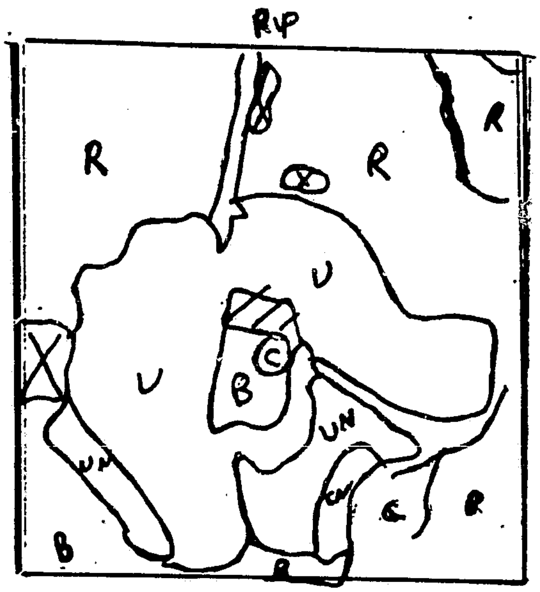

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SABLE

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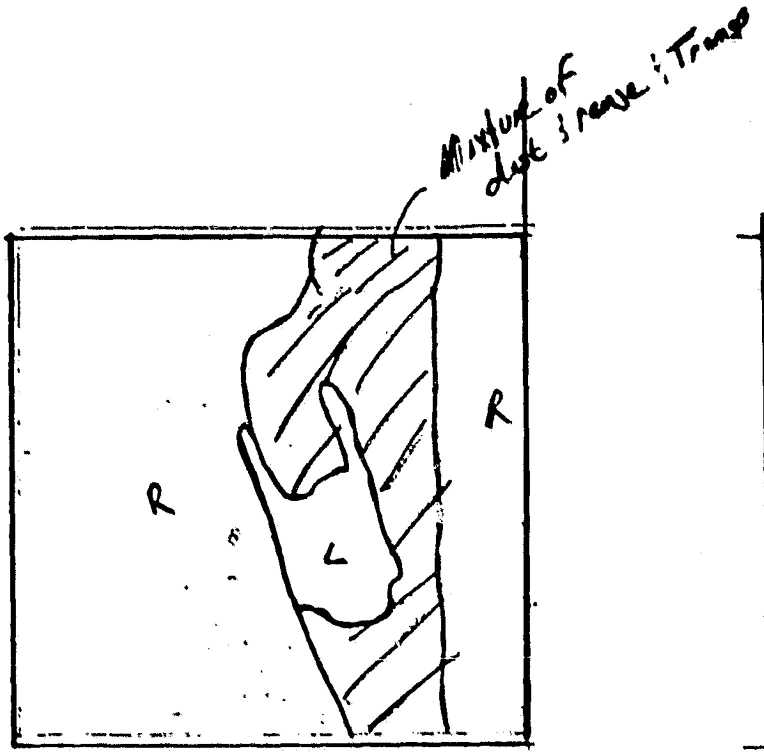

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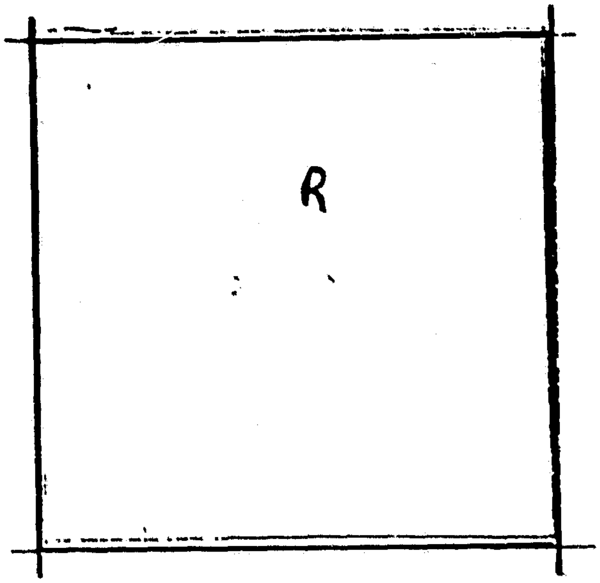

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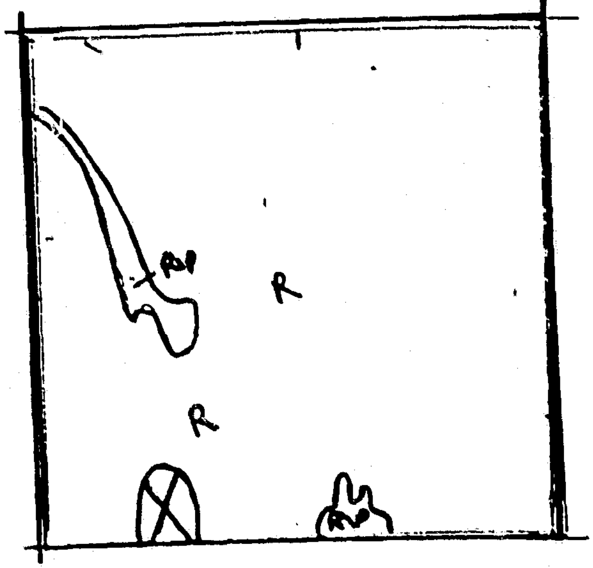

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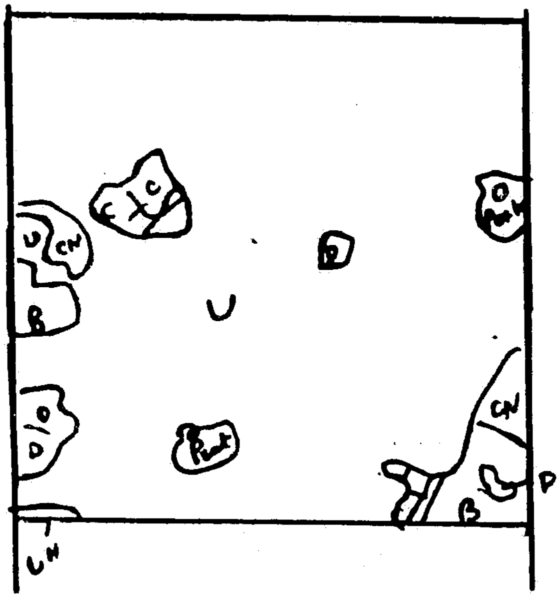

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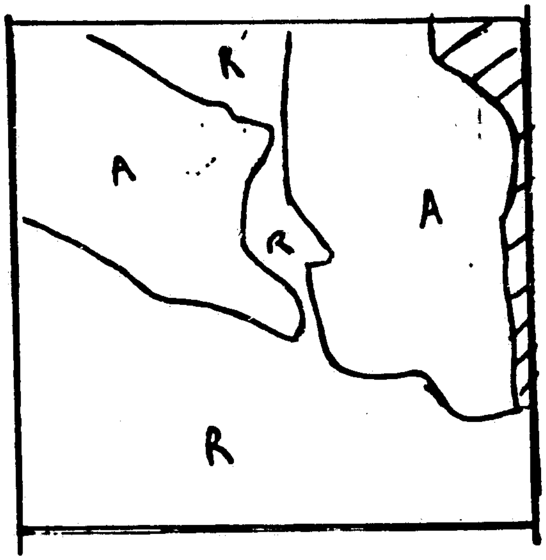

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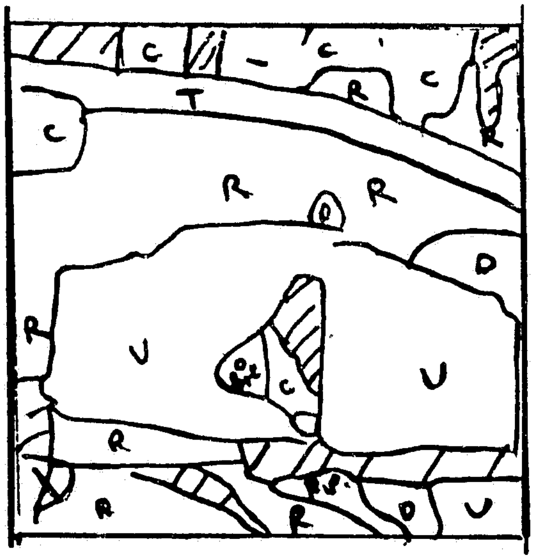

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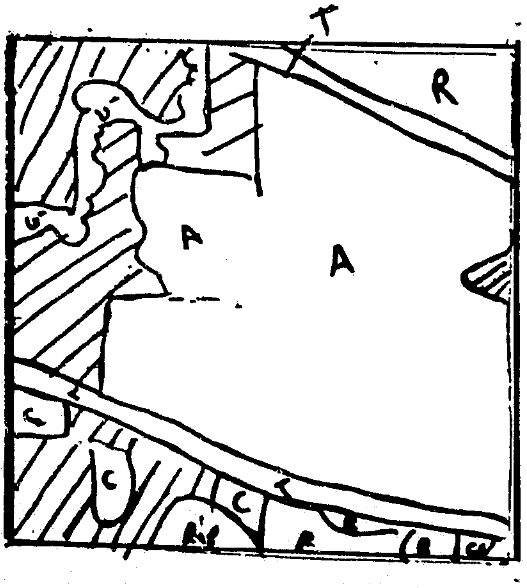

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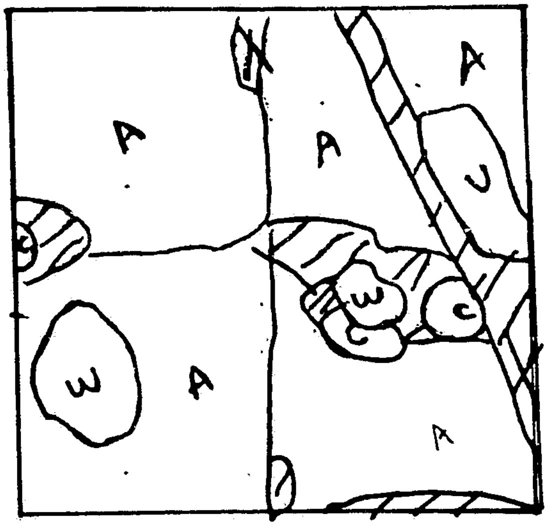
COMMERCE CITY/EAST LAKE



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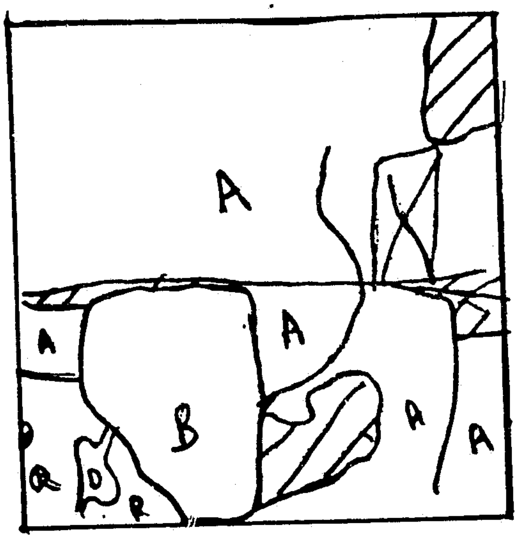

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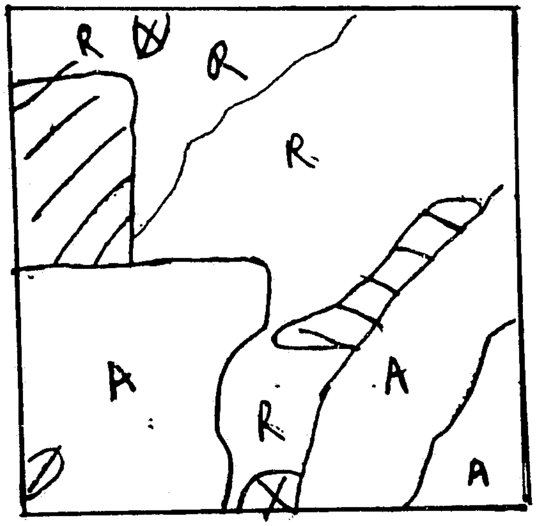

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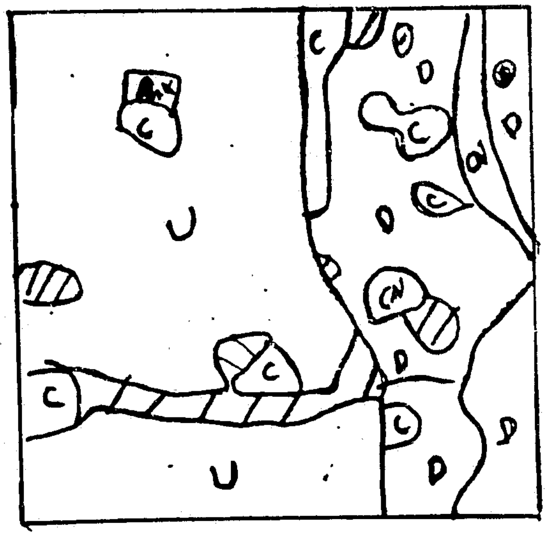

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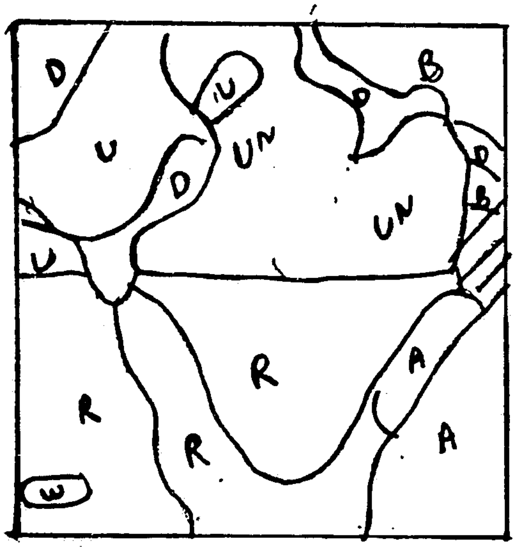

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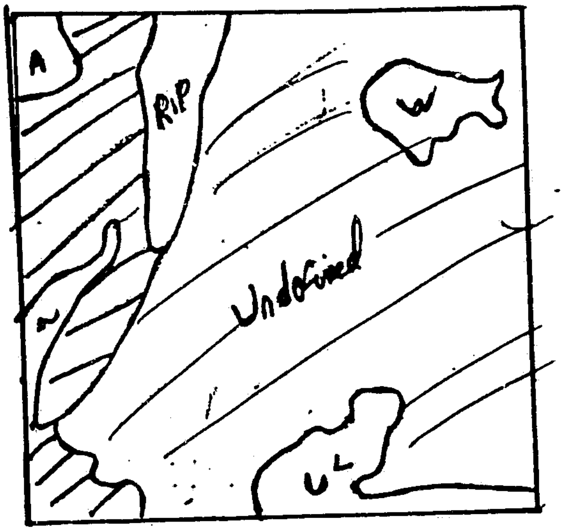

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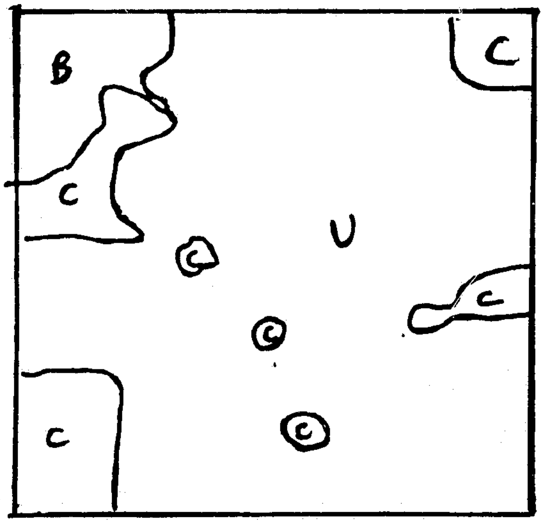

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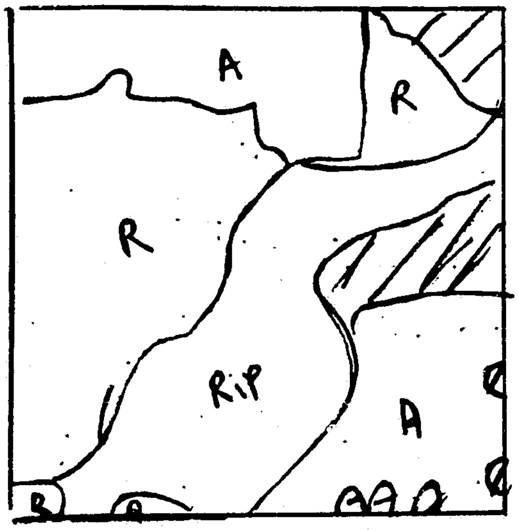

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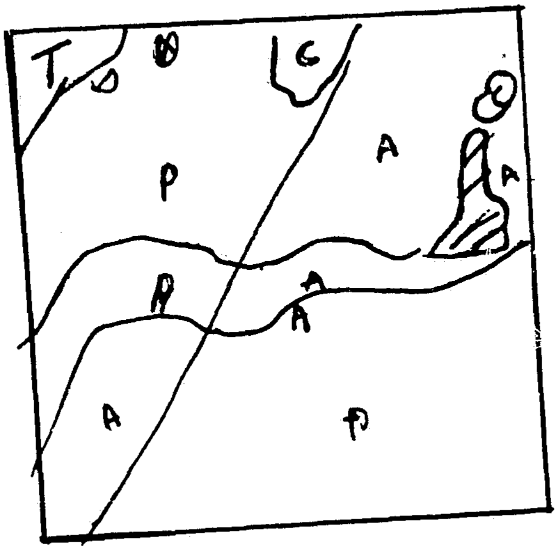

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LITTLETON

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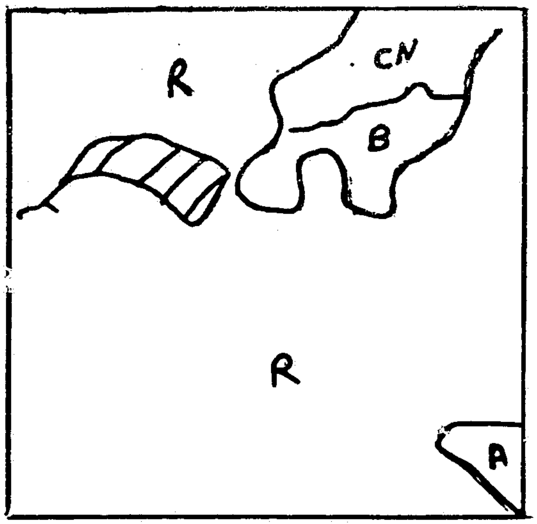

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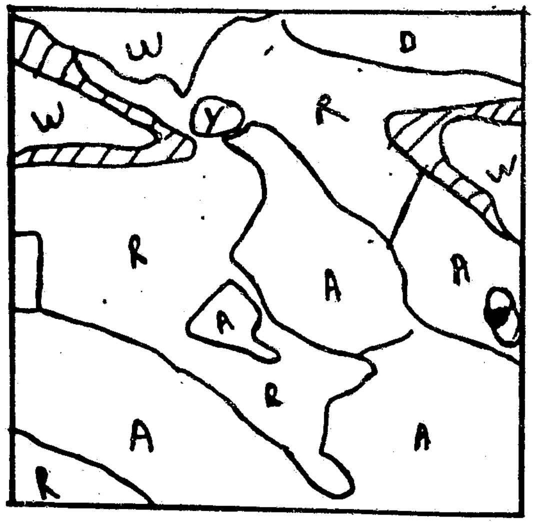

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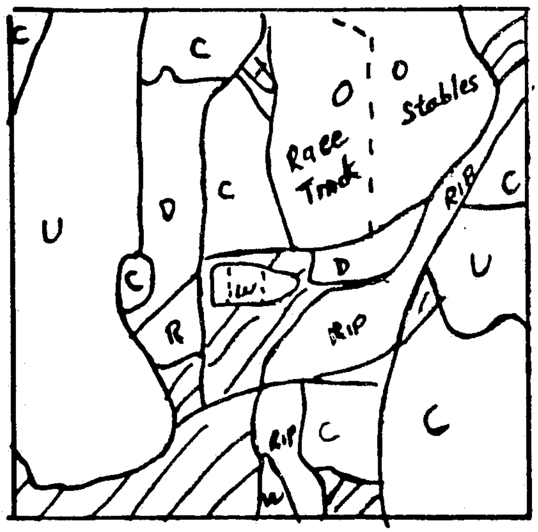

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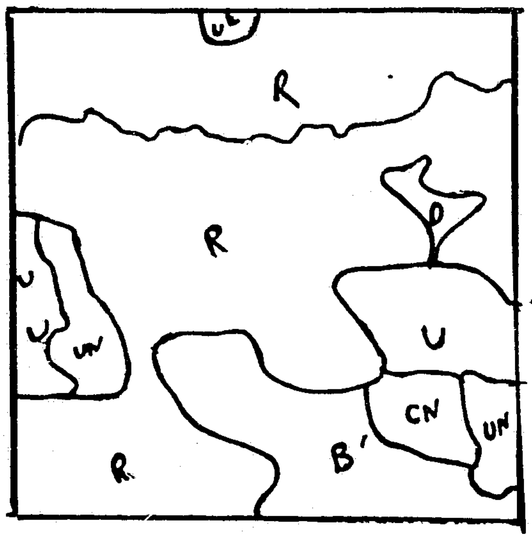

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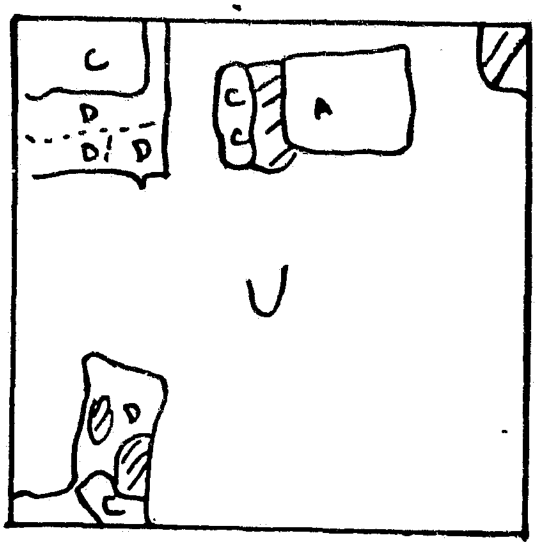

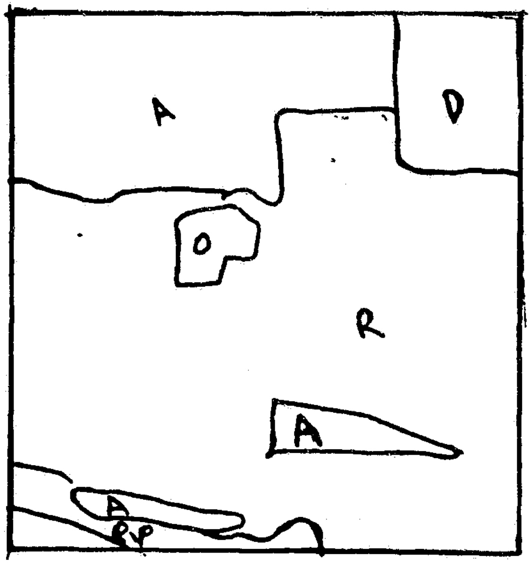

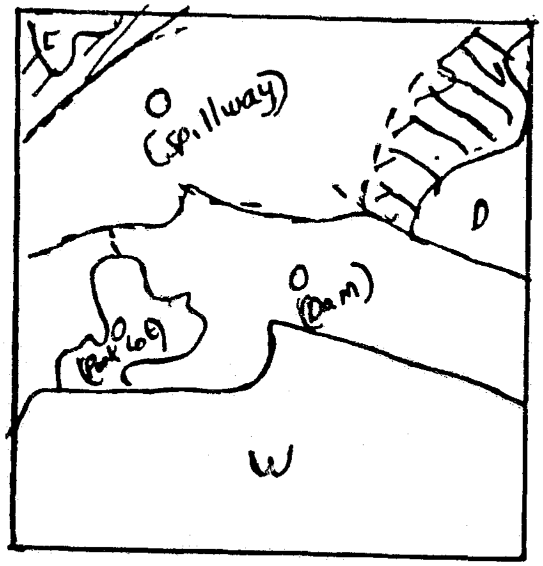

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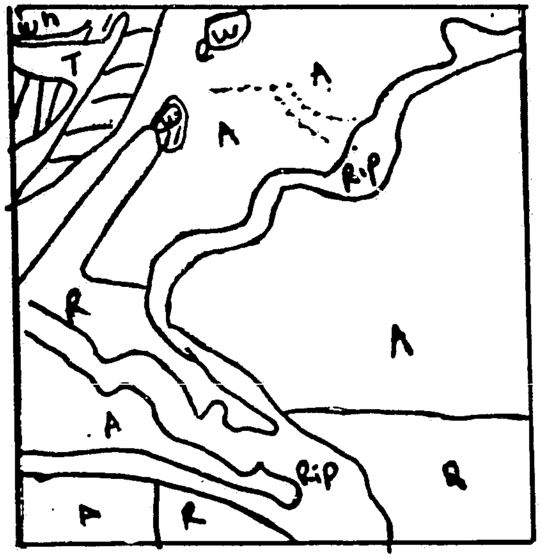

Appendix D

Results of Photo-Interpretation

The data which follow represent the ground truth grids which were obtained by digitizing the original photo-interpretation overlays supplied by NASA. They are arranged by quadrangle in two sections:

PHASE ONE

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REGION... FITZSIMMONS
GRID..... 1

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LLLLLLLLLLLLLLLLLLLLLLLDD
CLLLLLLLLLLLLLLLLLLLLLHHH
CCCDLLLLLLLLLLLLLLLLHHHHH
CCCCDLLLLLLLLLLLLLLHHHHHH
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CAALABHHHHHDDDDDDDDHDHHHH
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CRRRRUUDDCCCCDDDDDDDDHHHH
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AAAAAAACCDDCCCCCHHHDDDHHH
AADDDAACCDDCCCCCHHHDDDHHH
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REGION... FITZSIMMONS
GRID..... 2

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UUTAAAAAAAAAACCCCCCDDDDDD
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UTTTRRLLRRRRCCCCDDDCCCDDD
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REGION... FITZSIMMONS
GRID..... 3

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REGION... F...
GRID..... 4

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CAALLLLLLDDDDDLLLLLLLLLLL
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REGION... FITZSIMMONS
GRID..... 5

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CCDDBBDDDCLLLCDDDDLLLLLLDD
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RRRRDDDDBBLLLBBBBBBDDCCCLL
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DDDCCCCBBDDDDRRRRDDDCCLLLL
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REGION... FITZSIMMONS
GRID..... 6

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AAAAAAAAAALLLLLLLAAAAAAAAA
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CAAALLLLLLLDDLLLLLLLLLLLLL
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REGION... FITZSIMMONS
GRID..... 7

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RDDDDDRRRRRRRTTRRRRRREERRR
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REGION... FITZSIMMONS
GRID..... 8

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REGION...     FITZSIMMONS
    GRID..... 9

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REGION...     SEVEN PINE
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TFFFFFDDDDTTTDTA
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REGION...     SEVEN PINE
    GRID..... 2

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LLLLDDDDAAAAAAAA
LLLLLLLLAAAAAAFA
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FFFFLLAAAAAAAAFF
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    GRID..... 4

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AAAAAAAAFFFFFFFF
AAAAAAAFFFFFFFFF
AFAAAFAAFFFFFFFF
AAAAAFFAAFFFFFFF
AAAAFFFAAFFFFFFF
AAAAAAFFFFFFFFFF
AAAAAAFFFFFFFFFF
AAAAAAFFFFFFFFFF
AAAAFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
```

```
REGION...     SEVEN PINE
    GRID..... 5

FFFFAAAAFBFFFFFA
BBFFFAABBAAAAAAA
BBDBDBBBAAAAAAAF
BBBBBBBBAAAAAAAF
BBBBBBBBBBBFAFFF
BDDBBBBBBBBBFFFF
BBBBDDBBBBBBBBFF
BBDDBBBBBBBBBBFB
BDDDFFFFFFFFFFBB
FFFFFFAFFFFFFFFF
FFFFFFFAAAFFFFFF
FFFFFFFFAFAFFFFF
FFFFFFFFFFAAAFFF
```

```
REGION...     SEVEN PI
    GRID..... 6

LLLLLLLLLAAAAAAA
LLLLLLLFFFFAAAAA
FLFLLDFFFFAAAAAA
LLLFDDFFFFFFALAA
FFFLLLFFFFFFFFFF
LLLLLLFFFFFFLFFF
LLLLLFFFFFAFFFFF
LLLLFFFFFAAAFFFF
FFLLFFFAAAAAFFFF
AAFFFAAAAAAAFFFF
AAAAAAAAAFDDFFFF
AAAAAAAFFFFFFFFF
AAAAAAAFFFFFFFFF
```

ORIGINAL PAGE IS
OF POOR QUALITY

REGION... SEVEN PINES
GRID..... 7

```
FFDFFFFAAAAAAADD
FFDFFFFFFFFFFFFF
FFDAAALLFLLFFLFA
FFDAAAAFFLLLLLLA
FFDAAAAAFFLLLLLA
FFDAAAAAFDDLLLAA
AARDAAAAFFFFFFLA
AAABBAAAFAAFFLLA
AAABBAAFFAAFFFLL
AAAAAAFBCCCDDLLL
AAAAAFFBBBBLLFFF
AAAAFFFBBBBLLFFF
CAAAAFBBBFFFLFFF
```

REGION... SEVEN PINES
GRID..... 8

```
FFFFTFCFFFFFFFFF
LLFLLDLFFFFFFLLL
LLLLLDTLFFLLLLLL
LFLFFTDDFLLLLLLL
LLFLLLFDLLLLLLLF
LFLLLFLLTLLTLLFF
FLLLLLLLLLLLLFFF
LLLFLLLLLFFTLFFD
LFLLLLLLLFLLLFFF
LLLLLLLLLLLLLFFL
LLLLLLLLLLLLFFLL
LLLLLLLLLLLLLLLL
LLLLLLLLLLLLLLLL
```

REGION... SEVEN PINES
GRID..... 9

```
FFFFFDDDDFFFFFFF
FFFFFDDDDDFFFFFF
FFFFDDFFDFFFFFFF
FFFFDDFFFDFFFFFF
FFFDDDFFFFDDDFFF
FFFDDFFFFLFDDFFF
DDDDDFFLLFFFDBFF
ADDDFLLFFFFFBBBB
AFFFFLLFFFFFFBBB
AFFFLLLFDFFFFBBB
LLLLLFDDDFFFBFFB
LFFFFDDDDFFFBBBB
FFFFFDDFFFBBBBBB
```

REGION... SEVEN PINES
GRID..... 10

```
AAAAAAAAAAAAACCC
AFAFFAAAAAAAAACC
FFAFFFAAAAAAACCC
AAAAFFAAAALDAACA
LAAAAFFLLLLLDDAA
LAAAFFFLLLLLDCAA
AAAAAAFLLLLLDAAA
AAAAFFLFLLLDDAAF
AAAFLLLLLLLFAAAF
AALLLLLLFLLLAAAF
ALLLLLLLFFFFFFFF
ALLLLLLLFFFFFFFF
ALLLLLLFLFFFFFLL
```

REGION... SEVEN PINES
GRID..... 11

```
FFFTFTTFFFFFFTTTF
FFFFFTFFFFTFFFFLL
FFFFFTFFFFFFFFLLL
FFFFFFFFFFFFFLLLL
FFFFFFFFFFFFLLLLL
FFFFTFFFFFFFFLLLL
FFFFFFFFFFFFFLLLL
FFFTFFFFFFFFLLLLL
FFFTFFFFFFFFLFCCL
FFFFFFFFFFFFFCCCC
FFFFFFFFFFFFCCCTT
FFFFFFFFFTDDDDDDA
FFFFTDDDDDDDDDDAA
```

REGION... SEVEN PINES
GRID..... 12

```
HFFFFFFFFFFDFFFF
FFFFFFFFFFFFALFF
FFFFFFFFFFFFALLA
FFFFFFFFFFFFFAAF
FFFFFFFFFFFFAAAF
TTTTTFFFFFFFFFAA
FFFFFFTTTTFFFFFF
FFFFFFFFFFFTTTFF
FFFFFFFFFFFFFFTT
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
```

```
REGION...      CHESTERFIELD
    GRID..... 1

FAAALLLLFFFFFFFF
AAAALLLLFFFFFFFF
AAAAAALLLLFFFFFF
AAAAALLLLLLLFFFF
AAAAALLLLLLLFFFF
AAAAALLLLLLLLFFF
AAAAALFLLLLFLFFL
AALLLLFLLLLLLFFL
LLLLLLLLLLLLLFFF
LLLLLLLLLLLLLFFF
FFFFLLLLLLLFLFFF
FFFFLLLLLLLFLFFF
FFFLLLLLLLLLLLFF
```

```
REGION...      CHESTERFIELD
    GRID..... 2

LFFFFFAAAAFFFDDD
FFFFFAAAAAAFFFDD
FFFFAFAAAAAAFFFD
FFFFFFFFAFFAFFFF
FFFFFFFFFFFFFFFF
FFFFFFCCCFFFFFFF
FFFFFFCCCFFFFFFF
LLFFFFFDFFFFFFFF
LLLFFDDDDDDDDFFF
LLLLLLLATDTDDDFF
LLLLLAAAAFFFFFFF
LLLLLAAAAAAFFFFF
LLLLLLAAAAAFFFFF
```

```
REGION...      CHESTERFIELD
    GRID..... 3

FFFFDDAAAAAAFFFL
LFFDFAAAAAAFFFFL
LLLDFAAAAAAFFFLF
LFLFFFAAAAAAFFFF
LLLFFFFAAAAAFFFF
LLLFFAFAALLLAAAA
LLLFFAFFAALAAAAA
LLLLLLLLAAAAFFCC
LLLLLLLLLAFFFFCC
CCLLLLLLLFFFFFDD
LLLLLLLCCCCFTFDD
LLLLLLCCCCCDDFFF
AALLLLCCTCCDCDDF
```

```
REGION...      CHESTERFIELD
    GRID..... 4

FFFFFFFFFFFFFFFA
FFFFFFFFFFFFFFFA
FFFFFFFFFFFFFFFA
FDFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
DDDFFFFFFFFFFFFF
DDDFFFFFFAFFFFFA
FFFFFFFFFAAFFFFA
FFFFFFFFFAAAFAAF
DDDFFFFFFFAAAFAF
DDDFFFFFFFAAAAFA
FDDFFFFFFFAAAAAA
FDFFFFFFFFFAAAAA
```

```
REGION...      CHESTERFIELD
    GRID..... 5

LLFFFFAAAFFAAFFF
LLFWFFFAAAAFFFFF
FFFLFAAAAFFFFFLF
AFFLAAAAAALLFFLF
AFFAAAAAAAAALLFF
AFFAAAAAAAAALLFF
AFFFFFAAAFFAALLL
FFFFFFFFFFFFFFFL
FFFFFDDFFTTTFFFL
FFCCCCFFFFFFFFLL
CCCCCCFFFFFFFDDD
CCCCCFFFFFFFFFFD
CCCCFFFFFFFFFFFF
```

```
REGION...      CHESTERFIELD
    GRID..... 6

LLLFFFFFFFFFFFFF
LFFFFFFFFFFFFFFF
FLLLCFFFFFFFFFFF
FLLLLLFFFFFFFFFF
FLFLLLFFFFFFFFFF
LLLLFLFFFFFFFFFF
FLLLFLFFFFFAAAAA
FFLLFLFFFFFAAAAA
FFFLLLFFFFAAAAAA
BBFLLLFFFAAAAAAA
BFFFLLFFFAAFFAAF
FFFFLFFFFFFFFFFF
FFFFLFFFFFFFFFFF
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
REGION...     CHESTERFIELD
    GRID..... 7

LFFFFFFFFFFFFTFF
FFFFFFFFFFFTFTFF
FFFFFFFFFFFTFTFF
FFFFFFFFFFFFFFFF
FFFFFAAAAFFFFFFF
AAAAAAAAFFFFFFFF
AAAAAFFFFFFFFFFF
AAFFFFFFFFFFFFFF
AAAFFFFFFFFCFFFF
AAAFFFFFCCCCCFFF
AAAFFCCFCCFCFCCA
AAALFFCCCCCCCCCA
AAALLFCFCCCAAFAA
```

```
REGION...     CHESTERFIELD
    GRID..... 8

FFFFFFAAAAAAAAAA
FFFFFLAAAFAAAAAF
FFFFLLAAFFFFFFFF
FFFLLLAFFAAAAAAF
FFFLLLAFFFFLFFFF
LLLLLLFFFFFFFAAF
LLFLLLLFFAAAAAAF
FFFFLFFFAAAAAAAA
FFFFFFFAAAAAAAFF
FFFFFFFFFAAFFFFF
FFFFFFFFFFFFFFFD
FFFFFFFFFFAAAFFF
FFFFFFFFFFFFFFFF
```

```
REGION...     CHESTERFIELD
    GRID..... 9

FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFFFTFFFF
FFFFFFFFFFFTFFFF
FAAAFFFFFFFFFFFF
FFAAFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFTFFF
FFFFFFFFFFFFTFLL
FFFFFFFFFFFFTFFT
FTFFFFFFFFFFTFFF
FFFTFFFFFFFFTFFF
```

```
REGION...     CHESTERFIELD
    GRID..... 10

FFFTFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FTFTFFFFFFFFFFFF
TFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
```

```
REGION...     CHESTERFIELD
    GRID..... 11

FFFFTFFFFFFFFFFL
FFFTFFFFFFFFFFFF
FFTFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FTFFFFFFFFFFFFFF
TFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
```

```
REGION...     CHESTERFIELD
    GRID..... 12

FFFFFFFFFCFFTFTT
FFFFFFFTFTFFFFFT
FFFFFFFFFFFCFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFLLFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFFFFLFFFFFFFFFF
FFFFFLLFFFFFFFFF
FFFFFFFFLFFFFFFF
```

PHASE TWO

ORIGINAL PAGE IS
OF POOR QUALITY

```
REGION...      HIGHLAND RANCH
    GRID..... 1

!^^^^^^^^^^^^^^00000^0000
!^^^^^^^^^^^^^^^^^^^^^000
!!!^^^^^^^^^^^^^^^^^^^000
!!!^^^^^^^^^^^^^^^^^^0000
!0!!^^^^^0000^^^00^^^0000
!0!!00^^^^^000^^0^AAAAA^^
!000!!^^^^^^^0^^0AAAAAA^^
!!0!!!^^^^^^^^^00AAAAAAA^
00000^^^^^^^^^^AAAAAAAA^^
000^^^^^^^^^^^^^AAAAAA00^
000000^^^^^^^^^^^^^^^^000
000000^^^^^^^^^^^^^^^^^00
0000000^^^^^^^^^^^^^^^^^0
00000000^^^^^^^^^^^^^^^^0
00000000^^^^^^^^^^^^^^^^0
0000000^^^^^^^^^^^^^^^^^0
0000000^^^^^^^^^^^^^^^^00
000000^^^^^^^^^^^^^^^^^00
000000^^^^00000^^^^^^^0CC
[illegible]
[illegible]
```

```
REGION...      HIGHLAND RANCH
    GRID..... 2

$$$$$$$$$RRROOORRRRRRCCCC
$$$$$$$$$RRROOORRRRRRCCCC
OO$$$$$$$$RRRRRRRRRRRRRCC
OOO$$$$$$$$RRRRRRRRRRRRRR
OOO$$$$$$$$RRRRRRRRRRRRRR
AAOO$$$$$$$RRRRRRRRRRRRRR
AAAOO$$$$$$OOOORRRRRRRRRR
AAAAAAOO$$$$$$OORRRRRRRRR
AAAAAAAAOOO$$$OORRRRRRRRR
AAAAAAAAAAAOO$$ORRRRRRRRR
AAAAAAAAAAAAOO$$RRRRRRRRR
AAAAAAAAAAAAAAAA$$$RRRRRR
AAAAAAAAAAAAAAAAADD$$RRRR
AAAAAAAAAAAAAAAAADD$$RRRR
AAAAAAAAAAAAAAAAAADDD$RRR
AAAAAAAAAAAAAAAAAAAADD$RR
AAAAAAAAAAAAAAAAAAAAADD$R
AAAAAAAAAAAAAAAAAAAAAAAD$
AAAAAAAAAAAAAAAAAAAAAAAAA
[illegible]
[illegible]
```

```
REGION...      HIGHLAND RANCH
    GRID..... 3

CTTTTCCCCCRRRBBBOO$RRRRROO
CCCTTCCCCCRRRBBBO$RRRRROO
CCCCTCCCCCCRROOOO$RRRRRRRR
OCCCTTCCCCCCCOOOO$RRRRRRRR
OCCCCTCCCCCCCCCCCCRRRRRRR
OOCCOTTCCCCD@@CCCCCRRRRRR
OOCCOOTTCCDDDDDDDDDRRRRRR
OOOCCCCTOOODDDDDDCRRRRRR
OOOCCCCTTOODDDDDCCCRRRRRR
OOOCCCCCTOCDDDCCCCCDRRRRR
OOOCCCCCCTCCDDCCDDDDR$$RRR
OOOOCCCCCTCDCCCDDDDDR$$RRR
OOOCCCCCCCTDDCCDDDDRR$RRRR
CCCCCCCCCCTTCCCDDDDDR$$RRR
CCCCCCCCCCCTDDDDDDDDRRRRR
CCCCCCCCCCRRTODDDDD@@RCRRO
RRRRCCCCCCCRTDDDDDCCCCCRR
RRRRCCCCCCCRRTDDDCCCCCCCRR
RRRRRCCCRRRRRTTDDCCCCCC###
RRRRCCCRRRRRRTTTCCCC@#####
[illegible]
```

```
REGION...      HIGHLAND RANCH
    GRID..... 4

CUUUUUUUUUUUUUUUUUCCCCCCC
CUUUUUUUUUUUUUUUUUCCCCCCC
UUUUUUUUUUUUUUUUUUCCCCCCC
UUUUUUUUUUUUUUUUUUCCCCCCC
UUUUUUUUUUUUUUUUUUCCCCCCC
UUUUUUUUUUUUUUUUUUCCCCCCC
UUUUUUUUUUUCCUUUUUCCCCCCC
UUUUUUUPPPOOCUUUUCCCCCCCC
UUUUUUUPPPPOPPUUUUCCCCCCC
UUUUUUUPPPPPPUUUUUUUUOOOOO
UUUUUUUUPPUUUUUUUUUUCCCCC
UUUUUUUUUUUUUUUUUUUUUCCCC
UUUUUUUUUUUUUUUUUUUUUCCCC
UUUUUUUUUUUUUUUUUUUUUCCCC
UUUUUUUUUUUUUUUUUUUUUCCCC
UUUUUUUUUUUUUUUUUUUDDDDDD
UUUUUUUDDDUUUUUUUUUOODDDDD
UUUUUUUDDDUUUUUUUUUOOOOOOD
UUUUUUUUDUUUUUUUUUUOOOOOOD
UUUUUUUUUUUUUUUUUUUOOCCCCC
[illegible]
```

```
REGION...     HIGHLAND RANCH
    GRID..... 5

UUUUUUUUUUUUUUOODDCCCCDDDDD
UUUUUUUUUUUUUUUDDD CCDDDDD
UUUUUUUUUUUUUUDDDDCCCDDDDD
UUUUUUUUUUUUUUDDUDUUDDDD++
UUUUUUUUUUUUUDUUUUUU++++++
UUUUUUUUUUUUUUUUUUU+++++++
UUUUUUUUUUUUUUUUUUUUUU++++
UUUUUUUUUUUUUUUUUUUUUUUU++
UUUUUUUUUUUUUUUUUUUUUUUUUD
UUUUUUUUUUUUUUUUUUUUUUUDDD
UUUUUUUUUUUUUUUUUUUU++DDDD
OUUUUUUUUUUUUUUUPUU+++++++
OUUUUUUUUUUUUUUPUUU+#++++O
UUUUUUOOOUUUUUPPPUU###++++
UUUUUUOCOUUUUUUPPUU###++++
UUUUUUUCCCUUUUUPPPD######+
UUUUUUUCCCUUUUUPPOO######+
OOUUUUUUUUUUUUUPOOO#######
OOOUUUUUUUUUUUUPOOO#######
OOOOUUUUUUUUUUUPOOO#######
[illegible]
```

```
REGION...     HIGHLAND RANCH
    GRID..... 6

DDDDDDDDDDDDDDDUUUUUUCDCCC
$$$$$DDDDDDDDUUUUUUUUUDDCC
$UUUU$$DDUUUUUUUUUUUUUDCCC
UUUUUUU$UUUUUUUUUUUUUUCDDD
UUUUUUUU$UUUUUUUUUUUUUDDDD
UUUUUUUUUOOOUUUUUUUUUUDDCC
UUUUUUUUUCCCOUUUUUUUUUUUUU
UUUUUUUUUCUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUU%%%
UUUUUUUUUUUUUUUUUUUUUU%%%%
UUUUUUUUUUUUUUUUUUUUUDD%%%
UUUUUUUUUUUUUUUUUUUUDDDDD%
[illegible]
[illegible]
```

```
REGION...     HIGHLAND RANCH
    GRID..... 7

RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
[illegible]
```

```
REGION...     HIGHLAND RANCH
    GRID..... 8

RRDDDDDDDDDRRRRRRRRRRRRRRR
RRDDDDDDDDDRRRRRRRRRRRRRRR
RRORRRDDDDRRRRRRRRRRRRRRRR
ROORRRDDDDRRRRRRRRRRRRRRRR
ROORRDDDDDRRRRRRRRRRRRRRRR
ROOORRDDDDDDRRRRRRRRRRRRRR
OOOOOORRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
[illegible]
```

```
REGION...     HIGHLAND RANCH
    GRID..... 9

RRRRRRRRRRR$RRRRRRRRRRRRROO
RRRRRRRRRRR$ORRRRRRRRRRRRRR
RRRRRRRRRRR$ORRRRRRRRRRRRRR
RRRRRRRRRRROORRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRROOORRRRRRRRRRR
RRRRRRRRRRR$UUUURRRRRRRRRRR
RRRRRRUUUU$UUUUUURRRRRRRRR
RRRRRUUUUUUUUUUUUUURRRRRRRR
RRRUUUUUUUUUUUUUUUURRRRRRR
RRRUUUUUUUUUOUUUUUURRRRRRR
RRRUUUUUUUUOOOOUUUUUUUUUURR
OOOUUUUUUUUBBCCOUUUUUUUUURR
OOUUUUUUUUUBBCBOOOUUUUUUURR
OOUUUUUUUUUBBBBO++OOUUUUURR
B++UUUUUUUBBBUU++++OOOOORR
B+++UUUUUUUUUUU+++++OOORRR
BB+++UUUUUU+++++##RRRRRRRR
BBBB++UUUUU++++##RRRRRRRRR
BBBB#++UUUUU++++##RRRRRRRRR
BBBBB++UUUUU++++##RRRRRRRRR
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
REGION...      SABLE
    GRID..... 1

RRRRRRRRRRRRRRROOOOOORRRRR
RRRRRRRRRRRRRRROOOOOORRRRR
RRRRRRRRRRRRRRROOOOOORRRRR
RRRRRRRRRRRRRROOOOOOORRRRR
RRRRRRRRRRRROOOOOOOOORRRRR
RRRRRRRRRRROOOOOOOOOORRRRR
RRRRRRRRRRROOOOOOOOOORRRRR
RRRRRRRRRRRROOOOCOOOORRRRR
RRRRRRRRRRRCOOOOCOOOORRRRR
RRRRRRRRRRRROOOOOCOOORRRRR
RRRRRRRRRRRRCOOCCCOOORRRRR
RRRRRRRRRRRRCCCCCCOOOORRRR
RRRRRRRRRRRRRCCCCCCOOORRRR
RRRRRRRRRRRRRCCCCCCOOORRRR
RRRRRRRRRRRRRCCCCCCOOORRRR
RRRRRRRRRRRRRRCCCCCOOORRRR
RRRRRRRRRRRRRROOOOOOOORRRR
RRRRRRRRRRRRRROOOOOOOORRRR
RRRRRRRRRRRRRRROOOOOOORRRR
RRRRRRRRRRRRRRROOOOOOORRRR
[illegible]
```

```
REGION...      SABLE
    GRID..... 2

RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
[illegible]
[illegible]
```

```
REGION...      SABLE
    GRID..... 3

CCCCCCCCCCCCCCCCCCOOOOOOOO
CCCCCCCCCCCCCCCCCCCCCDDOCC
CCCCCCCCCCCCCCCRRRCCDDDCCR
CCCCCCCCCCCCCCRRRRRRDDDRRR
CCCCCCCCCCCCCCRRRRRRRRRRRR
CCCCCCCCCCRRRRRRRRRRRRRRRR
CCCCCCCCCCRRRRRRRRRRRRRRRR
CCCCCCCCCCRRRRRRRRRRRRRRRR
CCCCCCCCCCRRRRRRRR$$$$$RRR
RRRCCCCRRRRRRR$$$$$$$$$$$$
RRRRCCRRRRRRR$OOOOOOOOO$$$
RRRRRRRRRRRRRROOOOOOOOOR$$
RRRRRRRRRRROOOOOOOOOOOORRR
ORRRRRRROOOOOOOOOOOOORRRRR
OOOOOOOOOOOOOOUUOOOOORRRRO
OUUOOOOUUUUUUUUOOOOOOOOOOO
OUUUUUUUUUUUUUOOOOOOOOOOOO
$OUUUUUUUUUUUOOOORROOO$$$O
$OUUUUUUUUOOOOORRRRRRR$$OO
$$OUUUUUUUORRR$$$RRRRRROOO
[illegible]
```

```
REGION...      SABLE
    GRID..... 4

RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
$RRRRRRRRRRRRRRRRRRRRRRRRR
R$RRRRRRRRRRRRRRRRRRRRRRRR
RR$RRRRRRRRRRRRRRRRRRRRRRR
RRR$RRRRRRRRRRRRRRRRRRRRRR
RRR$$RRRRRRRRRRRRRRRRRRRRR
RRR$$RRRRRRRRRRRRRRRRRRRRR
RRRR$RRRRRRRRRRRRRRRRRRRRR
RRRR$$RRRRRRRRRRRRRRRRRRRR
RRRR$R$$RRRRRRRRRRRRRRRRRR
RRRRRR$$RRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRROORRRRRRRRRRRRRRRRRRRR
RRRROOORRRRRRRRR$$RRRRRRRR
[illegible]
```

```
REGION...      SABLE
    GRID..... 5

UUUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUCCUUUUUUUUUUUUUUUUUOO
UUUUCCCCCUUUUUUUUUUUUUUUUOO
UU#CCCCCUUUUUUUUUUUUUUUUUOO
U###UUUUUUUUUUUDDUUUUUUUUUU
BUUUUUUUUUUUUUUUUUUUUUUUUUU
BBBUUUUUUUUUUUUUUUUUUUUUUUU
BBBUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUU#
OOUUUUUUUUUUUUUUUUUUUUUUU##
OOOUUUUUUUUUUUUUUUUUUUUUU###
DDUUUUUUOOOUUUUUUUUUUUUUBBB
DDUUUUUUOOUUUUUUUUUUUOUUBBBB
UUUUUUUUUUUUUUUUUUUUUUOOBBDD
[illegible]
```

```
REGION...      SABLE
    GRID..... 6.

AAAARRRRRRRRRRAAAAAAAAAOOOO
AAAAAARRRRRRRRAAAAAAAAAOOOO
AAAAAAAARRRRRRAAAAAAAAAAOOO
AAAAAAAAAAAARRAAAAAAAAAAAOO
AAAAAAAAAAAAARAAAAAAAAAAAAO
AAAAAAAAAAAAARAAAAAAAAAAAAA
AAAAAAAAAAAAARAAAAAAAAAAAAA
AAAAAAAAAAAAARAAAAAAAAAAAAO
RAAAAAAAAAAAARRAAAAAAAAAAAO
RRRAAAAAAAAAARRRAAAAAAAAAAO
RRRRAAAAAAAAARRAAAAAAAAAAAO
RRRRRRAAAAAAAARAAAAAAAAAAAO
RRRRRRRRRRRRAARAAAAAAAAAAAO
RRRRRRRRRRRRRRRAAAAAAAAAAAO
RRRRRRRRRRRRRRRAAAAAAAAAAAO
RRRRRRRRRRRRRRRRRRRRRRAAAAO
RRRRRRRRRRRRRRRRRRRRRRRAAAO
RRRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRRR
```

```
REGION...      SABLE
    GRID..... 7

OOOOOCCCCOOCCCCCCCCCCCCCCOO
TTTOOCCCCOOCCCCCCCCCCCCCROO
CCTTTTTTTTTTTCCRRRRCCCCROR
CCCRRRRRRRTTTTTTTTTCCCRROR
CCCRRRRRRRRRRRRRRTTTTTRRRR
CCCRRRRRRRRRRRRRRRRRRTTTRR
RRRRRRRRRRRRRRRRRRRRRRRTTT
RRRRRRRRRRRRRRDDRRRRRRRRRR
RRRRRRRRUUUUUUUUURRRRRDDDD
RRRRRRUUUUUUUUUUUUURDDDDDD
RRUUUUUUUUUUUUOOUUUUUUUDDDD
RRUUUUUUUUUUUOOOUUUUUUUUUD
RRUUUUUUUUUUOOOOUUUUUUUUUU
RRUUUUUUUUUOOCOOUUUUUUUUUU
OUUUUUUUUUUOOOCCOUUUUUUUUU
OOUUUUUUUUUUUUCCCUUUUUUUUUU
OGRRRRUUUUUUUUUOOUUUUUUUUUU
OORRRRRRRRRROOOOOUUUUUUUUUU
OOORRROOOORROOOO$OOOOOOOOO
OOPPPPPPPPOOPPPP*$$$DDDUUUUU
[illegible]
```

```
REGION...      SABLE
    GRID..... 8

OOOOOOOOO*OOOTTTRRRRRRRRRR
OOOOOOOOO*OOOAAATTTRRRRRRR
OOO***OOO*OOOAAAAAATTTRRRR
OOO*OO****OOOAAAAAAAATTTRR
OOO*OO**OOOOOAAAAAAAAAAATT
OOO*OOAAAAAAAAAAAAAAAAAAAA
OOO*OOAAAAAAAAAAAAAAAAAAAA
***OOOOAAAAAAAAAAAAAAAAAAA
OOOOOOAAAAAAAAAAAAAAAAAAOO
OOOOOOOAAAAAAAAAAAAAAAAAOO
OOOOOOOOAAAAAAAAAAAAAAAAAA
OOOOOAAAAAAAAAAAAAAAAAAAAA
OOOOOAAAAAAAAAAAAAAAAAAAAA
OOOOAAAAAAAAAAAAAAAAAAAAAA
TTTTAAAAAAAAAAAAAAAAAAAAAA
CCOOOTTTAAAAAAAAAAAAAAAAAA
OOOOOOOTTTTAAAAAAAAAAAAAAA
OOOOCCOOOOOTTTTTAAAAAAAAAA
OOOOCCOOOOOCCCTTTTTTTTAAAAA
OOOOCCOO$$$CCRRRRRRRRTTTTT
OOOOOOO$$$$$$RRRRRRRDD###
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
REGION...      COMMERCE CITY
    GRID..... 1

BBBBBBBUUUUUUUUUUUUUUUCCC
BBBBBBBUUUUUUUUUUUUUUCCCC
BBBBBBUUUUUUUUUUUUUUUCCCC
BBBBCCBUUUUUUUUUUUUUUUUUU
BBBBCCCCUUUUUUUUUUUUUUUUU
BBBCCCUUUUUUUUUUUUUUUUUUU
BBCCCUUUUUUUUUUUUUUUUUUUU
CCCCCUUUUUUUUUUUUUUUUUUUU
CCCCCUUUUUUUUUUUUUUUUUUUU
CCCCCCUUUUUUUUUUUUUUUUUUU
UUUUUUUCCUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUCCC
UUUUUUUUUUUUUUUUUUUCCCCCC
UUUUUUUUUUUCUUUUUUUCUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUU
CCCCCUUUUUUUUUUUUUUUUUUUU
CCCCCUUUUUUUUUUUUUUUUUUUU
CCCCCUUUUUUUUUCCCUUUUUUUU
CCCCCUUUUUUUUUUCUUUUUUUUU
CCCCCUUUUUUUUUUUUUUUUUUUU
CCCCCUUUUUUUUUUUUUUUUUUUU
```

```
REGION...      COMMERCE CITY
    GRID..... 2

AAAAAAAAAAAAAAAAAAROOOOOO
AAAAAAAAAAAAAAAAAARRROOOO
AAAAAAAAAAAAAAAAAARRRROOO
AAAARAAAAAAAAAAAAARRRRROO
RRRRRRRRRRRAAAAAAARRRRRRR
RRRRRRRRRRRAAAAAAARRRRRR$
RRRRRRRRRRRRRRRRRRR$$$$$$
RRRRRRRRRRRR$$$$$$$$$$$OO
RRRRRRRRRRRR$$$$$$$$$OOOO
RRRRRRRRRRR$$$$$OOOOOOOOO
RRRRRRRRRRR$$$$$OOOOOOOOO
RRRRRRRRRR$$$$$$OOOOOOOOO
RRRRRRRRRR$$$$$$OOAAAAAAA
RRRRRRRRR$$$$$$$$AAAAAAAA
RRRRRR$$$$$$$$$$$AAAAAAAA
RRRRR$$$$$$$$$$$$AAAAAAAO
RRRRR$$$$$$$$$$$$AAAAAAAA
RRRRR$$$$$$$$$$$AAAAAAAAA
RRR$$$$$$$$$$$$AAAAAAAAAA
RR$$$$$$$$$$$$$AAAAAAAAAO
RR$$$OOOO$$$AAAAOOOOOOAAA
```

```
REGION...      COMMERCE CITY
    GRID..... 3

TTTTTTAOOAAAAACCCCAAAAAAA
TTTTTAAOAAAAAACCCAAAAAAAA
TTAAAAAAAAAAAACCCAAAAAAAA
TAAAAAAAAAAAAAAAAAAAAAACC
AAAAAAAAAAAAAAAAAAAAAAACA
AAAAAAAAAAAAAAAAAAAAAAOAA
AAAAAAAAAAAAAAAAAAAAAAOAA
AAAAAAAAAAAAAAAAAAAAAAOAA
AAAAAAAAAAAAAAAAAAAAAAOOA
AAAAAAAAAAAAAAAAAAAAOOOOA
AAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAA
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
REGION...      EAST LAKE
    GRID..... 1

AAAAAAAAAAOOAAAAAOAAAAAAA
AAAAAAAAAAOOAAAAAOOAAAAAA
AAAAAAAAAAOOAAAAAOAAAAAAA
AAAAAAAAAAOOAAAAAOOAAAAAA
AAAAAAAAAAAAAAAAAAOOUUUAA
AAAAAAAAAAAAAAAAAAOOUUUUA
AAAAAAAAAAAAAAAAAAAOUUUUA
AAAAAAAAAAAAAAAAAAAOOUUUA
OOOAAAAAAAAAAAAAAAAAOUUUU
COOOAAAAAAAOOOOOOAAAAOUUU
COOAAAAAAAAAOOOOOOOOOOOOO
AAAAAAAAAAAAAAOWWOOOOCOOO
AAWWAAAAAAAAAAOOOWWWOCCOO
AWWWWAAAAAAAAAACCCCOOCCOO
AWWWWWAAAAAAAAACCCCAAAAAO
WWWWWWAAAAAAAAAAAAAAAAAAO
AWWWWWAAAAAAAAAAAAAAAAAAO
AAWWWWAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAOAAAAAAAAAAA
AAPAHAAAAAAAAAOAAJOOOOOOO
```

```
REGION...      EAST LAKE
    GRID..... 2

AAAAAAAAAAAAAAAAAAAAAAOOO
AAAAAAAAAAAAAAAAAAAAAAOOO
AAAAAAAAAAAAAAAAAAAAAAOOO
AAAAAAAAAAAAAAAAAAAAAAOOO
AAAAAAAAAAAAAAAAAAAAAAOOO
AAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAOOOAAA
AAAAAAAAAAAAAAAAAAAOOOAAA
AAAAAAAAAAAAAAAAAAAOOOAAA
AAAAAAAAAAAAAAAAAAAOOOAAA
AAAAAAAAAAAAAAAAAAAOOOAAA
OOOOBBBBBBBBAAAAAAAAOOOOO
AAABBBBBBBBBAAAAAAAAAAOOO
AAABBBBBBBBBAAAAAAAAAAAAA
AAABBBBBBBBBAAAAAAAAAAAAA
RRRBBBBBBBBBAAOOOOOOAAAAA
RRRRBBBBBBBBAAOOOOOOAAAAA
RRRDDBBBBBBBOOOOOOOAAAAAA
RRRDRRBBBBBBOOOOOOOAAAAAA
RRRDRRRRRRRROOOAAAAAAAAAA
RRRRRRRRBBBBAAAAAAAAAAAAA
```

```
REGION...      EAST LAKE
    GRID..... 3

RRRRRROORRRRRRRRRRRRRRRRR
RRRRRROORRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRR
OOOOOORRRRRRRRRRRRRRRRRRR
OOOOOORRRRRRRRRRRRRRRRRRR
OOOOOORRRRRRRRRRRRRRRRRRR
OOOOOORRRRRRRRRRRRRRRRRRR
OOOOOORRRRRRRRRRRRRRRRRRR
OOOOOORRRRRRRRRRRRRROOOAA
OOOOOORRRRRRRRRRRRROOOAAA
OOOOOORRRRRRRRRRRROOOAAAA
AAAAAAAAAAAAAARRRROOAAAAA
AAAAAAAAAAAAAARROOOAAAAAA
AAAAAAAAAAAAAROOOOAAAAAAA
AAAAAAAAAAAARRRRAAAAAAAAA
AAAAAAAAAAAARRRRAAAAAAAAA
AAAAAAAAAAAARRRRAAAAAAAAA
AAAAAAAAAAAARRRRAAAAAAAAA
OOAAAAAAAAAARRRRAAAAAAAAA
OOAAAAAAAAAAROOOAAAAAAAAA
OOAAAAAAAAAOOOOAAAAAAAAAA
```

```
REGION...      EAST LAKE
    GRID..... 4

UUUUUUUUUUUUUCCCOODDDD#DD
UUUUUUUUUUUUUCCCDDODDD#DD
UUUUOOOUUUUUUCCDDDDDDD#DD
UUUUOOOUUUUUUCCDDCDDD##DD
UUUUCCCUUUUUUCCDDCCCC##DD
UUUUUCCUUUUUUCCDDDCCDCCDD
UUUUUUUUUUUUUCCDDDDDDD##D
UUUUUUUUUUUUUCCDDDDCCD##D
UUUUUUUUUUUUUUDDDDDDDDD##
UUUUUUUUUUUUUUDDDDDDDDDD#
OOOUUUUUUUUUUUODDDDDDDDDD
OOOUUUUUUUUUUUUD###DDDDD
UUUUUUUUUUUUUUUD#OOODDDD
UUUUUUUUUUOOOUUUUDDDOODDDD
UUUUUUUUUUOCCCUUOODDDDDDD
CCCOOOOUUUCCCCUUOODDDDDDD
CCCUUUOOOOOOOOOUUUCCDDDDD
UUUUUUUUUUUUUUUUUUCCDDDDD
UUUUUUUUUUUUUUUUUUDDDDDDD
UUUUUUUUUUUUUUUUUUDDDDDDD
UUUUUUUUUUUUUUUUUUUDDDDDD
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
REGION...      EAST LAKE
    GRID..... 5

DDDDUUU+++++++DDBBBBBBBBB
DDDUUUU+ +UU++DDDBBBBBBBB
DDDUUUUU+UUU++++DDDDDDBBB
DDUUUUUUUUU++++++DDDDDBBB
UUUUUUUUDD+++++++DDUUUUDD
UUUUUUUDDD+++++++++++++DD
UUUUUUUDD++++++++++++++BB
RUUUUUDD+++++++++++++++OO
UUUUUD++++++++++++++++OOO
UUURRR++++++++++++++++OOO
RRRRRRRRRRRRRRRRRRRRRRROO
RRRRRRRRRRRRRRRRRRRRRAAAA
RRRRRRRRRRRRRRRRRRRRAAAAA
RRRRRRRRRRRRRRRRRRRAAAAAA
RRRRRRRRRRRRRRRRRAAAAAAAA
RRRRRRRRRRRRRRRRRRAAAAAAA
RRRRRRRRRRRRRRRRRRAAAAAAA
RRRRRRRRRRRRRRRRRRAAAAAAA
RRRRRRRRRRRRRRRRRRAAAAAAA
WWWRRRRRRRRRRRRRRRAAAAAAA
RRRRRRRRRRRRRRRRRRAAAAAAA
```

```
REGION...      EAST LAKE
    GRID..... 6

AAOOOOO$$$$OOOOOOOOOOOOOO
AAAOOO$$$$OOOOOOOOOOOOOOO
AAAOOO$$$$OOOOOOOWWWWWOOO
OOOOOO$$$OOOOOOOOOWWWWWWO
OOOOOO$$$OOOOOOOOOWWWWOWO
OOOOOO$$$OOOOOOOOOOWOOOOO
OOOOOO$$$OOOOOOOOOOOOOOOO
OOOOOO$$$OOOOOOOOOOOOOOOO
OOOOOO$$OOOOOOOOOOOOOOOOO
OOOOWO$$OOOOOOOOOOOOOOOOO
OOWWOOOOOOOOOOOOOOOOOOOOO
OWWOOOOOOOOOOOOOOOOOOOOOO
WWOOOOOOOOOOOOOOOOOOOOOOO
WOOOOOOOOOOOOOOOOOOOOOOOO
WOOOOOOOOOOOOOOOOOOOOOOOO
OOOOOOOOOOOOOOOOOOOOOOOOO
OOOOOOOOOOOOOOOO&&OOOOOOO
OOOOOOOOOOOOO&&&&&OOOOOOO
OOOOOOOOOOOO&&&&&OOOOOOOO
OOOOOOOOOOOO&&&&&OOOOOOOO
OOOOOOOOOOOOOO&&&&&&&&&&&
```

```
REGION...       LITTLETON
    GRID..... 1

RRRRRRRRRRRRRRRRR########R
RRRRRRRRRRRRRRRR########RR
RRRRRRRRRRRRRR#########RRR
RRRRRRRRRRRRR#######BB#RRR
RRRRRRRRRRRRRR#@#BBBBBBRRR
RRRRROOORRRRRBBBBBBBBBRRRR
RRROOOOOOOORBBBRRBBBRRRRRR
RRRRRRROOOORBBBRRBBRRRRRRR
RRRRRRRROORRRRRRRBBRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
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RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRAAAA
RRRRRRRRRRRRRRRRRRRRRRHAAA
RRRRRRRRRRRRRRRRRRRRRRRRAA
[illegible]
```

```
REGION...       LITTLETON
    GRID..... 2

WWWWWWWWWWWRRRDDDDDDDDDDDD
OOWWWWWWWWWRRRRRDDDDDDDDDD
OOOORWWWWRRRRRRRRRRRRRRRRD
WWWWORRRRRRRRRRRRRRRRRRRRO
WWWWWWOOROOORRRRRRROOOOWWW
WWWWWWWOORRAAARRRRRROOWWWW
RRRRRRRRRRRRRAARRRRRROOWWW
RRRRRRRRRRRRRAAARRRRAAAOOW
RRRRRRRRRRRRAAAAAARRAAAAOW
ORRRRRRRRRRRAAAAAAAAAAAAAA
ORRRRRRRRRRAAAAAAAAAAAAAAA
ORRRRRRRRRAARAAAAAAAAAAAWW
AARRRRRRRAAAAAAAAAAAAAAAWW
AAAAARRRRAAAARAAAAAARRRAAW
AAAAAAAAARRRRARRRRAAAAAAAA
AAAAAAAAAARRRRRRRRAAAAAAAA
AAAAAAAAAAARRRRAAAAAAAAAAA
AAAAAAAAAAAAARRRAAAAAAAAAA
RRAAAAAAAAAAAARRAAAAAAAAAA
PPPPPAAAAAAAAAAPPPAAAAAAAA
[illegible]
```

```
REGION...       LITTLETON
    GRID..... 3

CUUUUUCCCCCCOOOOOOOOOOOOOO
CUUUUUCCCCCCOOOOOOOOOOOOOO
CUUUUUCDCCCOOOOOOOOOOOOOOO
UUUUUUDDDDCCCOOOOOOOOOOOOO
UUUUUUDDDDCCCOOOOOOOOOOO$C
UUUUUUDDDDCCCOOOOOOOOOO$CC
UUUUUUDDDDCCCOOOOOOOOO$CCC
UUUUUUDDDDCCCOOOOOOOO$$CCC
UUUUUUDDDDCCCCOOOOODD$UUUU
UUUUUUDDDCCCCCOOODDD$CCCCC
UUUUUCCDDOWWOOODDDD$$UUUUU
UUUUUCCDROWWWWOOO$$$OUUUUU
UUUUUDDRROOOOOO$$$$$OUUUUU
UUUUUURRROOOOO$$$$$OCCUUCC
UUUUUUUROOOOO$$$$$$CCCCCCC
UUUUUUUOOOOO$$$OOOOCCCCCCC
UUUUUUUOOOOO$$CCCCCCCCCCCC
UUUUUUUOOOOO$$CCCCCCCCCCCC
UUUUUUUOOOOO$$CCCCCCCCCCCC
OUUOOOOOOOOO$$$$OOCCCCCCCC
[illegible]
```

```
REGION...       LITTLETON
    GRID..... 4

RRRRRRRRRR&&RRRRRRRRRRKRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRDDRRRRR
RRRRRRRRRRRRRRRRRRRRDDDDRR
URRRRRRRRRRRRRRRRRRRRDDRRR
U++RRRRRRRRRRRRRRRRRRDRRRR
UU++RRRRRRRRRRRRRUUUUUUURR
UU++RRRRRRRRRRRRRUUUUUUUUU
UUU++RRRRRRRRRRRRRUUUUUUUU
UU++++RRBBBBRRRRRRRUUUUUUU
UU++++RBBBBBBRRRRRRUUUUUUU
UUU+++RRBBBBBBBBBB#####+++
RRRRRRRRRBBBBBBBBB#####+++
RRRRRRRRRRRBBBBBBBB#####++
RRRRRRRRRRRRRBBBBBBBBBBB++
RRRRRRRRRRRRRBBBBBBBBBBB++
[illegible]
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
REGION...      LITTLETON
    GRID..... 5

CCCCCCDDUUUUUUUUUUUUUUUUOO
CCCCCCDDUUCCOOAAAAAAUUUUOO
CCCCCCDDUUCCOOAAAAAAUUUUUU
DDDDDDDDUUCCOOAAAAAAUUUUUU
DDDDDDDDUUUCCOAAAAAAAUUUUU
DDDDDDDDUUCCOOUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUU
UUUDDDUUUUUUUUUUUUUUUUUUUU
UUUDDDUUUUUUUUUUUUUUUUUUUU
UUUDDDUUUUUUUUUUUUUUUUUUUU
UUUDDOOUUUUUUUUUUUUUUUUUUU
UUDDDOUUUUUUUUUUUUUUUUUUUU
UUDOCOUUUUUUUUUUUUUUUUUUUU
[illegible]
```

```
REGION...      LITTLETON
    GRID..... 6

AAAAAAAAOOOOOOOOUUUTOCCCCC
AAAAAAAA$OOOOOCRAAATOUUUUU
AAAAAAAA$$OOOCCAAAATOUUUUU
AAAAAAAA$$$OOCAAOOTOOUUUUU
AAAAAAAA$$$$ACAAOOTOOUUUUU
AAAAAAAA$$$$AABBBBTOUUUUUU
WWWWWW$$$$$AAABBBTTUUUUUUU
WWWWWW$$$$AAABBBBTTUUUUUUU
WWWWWW$$$AAAABBBBTTUUUUUUU
WWWWWW$$AAAAABBBBTTUUUUUUU
WWWOO$$AAAAAAABBBTOBUUUUUU
WWWOO$AAAAAAAABBBTOBBUUUUU
WWOOO$AAAAAAAAAAATOB++UUUU
WWOOO$AAAAAAAAAAATOB+++UUU
WWOOOO$AAAAAAAAAAOOBB++UUU
WWOOOO$OOAAAAAAATOOBB++UUU
OOOOOO$AAAAAAAAATOBRRRRRRR
OOOOO$AAAAAAAAAATRRRRRRRRR
OOOOO$OAAAAOOOOTRRRRRRRORR
OOOO$OOAAAOOOOOTRRRRRRRROO
[illegible]
```

```
REGION...      LITTLETON
    GRID..... 7

AAAAAAAAAAAAAAAAAAADDDDDDD
AAAAAAAAAAAAAAAAAAADDDDDDD
AAAAAAAAAAAAAAAAAAADDDDDDD
AAAAAAAAAAAAAAAAAAADDDDDDD
AAAAAAAAAAAAAARRRRRDDDDDDD
AAAAAAAAAAAAAARRRRRDDDDDDD
AAAAAAAAAAAAAARRRRRRRRRRRR
RRRAARRRRRRARRRRRRRRRRRRRR
RRRRRRRROOOORRRRRRRRRRRRRR
RRRRRRRROOOORRRRRRRRRRRRRR
RRRRRRRROORRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRAARRRRRRRRRR
RRRRRRRRRRRRRRAAAAAAAARRRR
RRRRRRRRRRRRRRRRRRRRRRRRRR
$$$RRRRRRRRRRRRRRRRRRRRRRR
[illegible]
```

```
REGION...      LITTLETON
    GRID..... 8

^^^^OOOOOOOOOOOOOOOOOOOOOO
^^OOOOOOOOOOOOOOOOOOOOOOOO
OOOOOOOOOOOOOOOOOOOOOOOOOO
OOOOOOOOOOOOOOOOOOOOOOOOOO
OOOOOOOOOOOOOOOOOOOOOOOOOO
OOOOOOOOOOOOOOOOOOOOOOODDD
OOOOOOOOOOOOOOOOOOOOODDDDD
OOOOOOOOOOOOOOOOOOOODDDDDD
OOOOOOOOOOOOOOOOOOOOODDDDD
OOOOOOOOOOOOOOOOOOOOOOODDD
OOOOOOOOOOOOOOOOOOOOOOOOOO
OOOOOOOOOOOOOOOOOOOOOOOOOO
OOOOOOOOOOOOOOOOOOOOOOOOOO
OOOOOOOOOOOOOWWWWOOOOOOOOO
OOOOOOOOOOOOOWWWWWWWWWOOOO
WWWWWWWWWWWWWWWWWWWWWWWWWW
WWWWWWWWWWWWWWWWWWWWWWWWWW
WWWWWWWWWWWWWWWWWWWWWWWWWW
WWWWWWWWWWWWWWWWWWWWWWWWWW
[illegible]
[illegible]
```

```
REGION...     LITTLETON
    GRID..... 9

~~~~OOOAAAWWAAAAAAAAAA$$AA
TTTTTTOOAAWWAAAAAAAAAA$$$$
TTTTTOOAAAAAAAAAAAAA$$AAAA
OOOTOOAAAAAAAAAAAAA$$AAAAA
OOTOOOAWWAAAAAAAAA$$AAAAAA
OTOOOAROOAAAAAAA$$$AAAAAAA
TOOAARRAAAAAAAAAA$$AAAAAAA
OAAARRAAAAAA$$A$$$$AAAAAAA
AARRRAAAAAAA$AAAAAAAAAAAAA
ARRRAAAA$$$$AAAAAAAAAAAAAA
RRRAAAA$$AAAAAAAAAAAAAAAAA
RRRRRRR$AAAAAAAAAAAAAAAAAA
$$RRRRR$AAAAAAAAAAAAAAAAAA
A$$$RRRR$$AAAAAAAAAAAAAAAA
AAA$$$$$R$$$AAAAAAAAAAAAAA
AAAAAAA$$RRR$AAAAAAAAAAAAA
AAAAAAA$$$$RR$RRRRRRRRRRRR
$$$$$$$$A$$$$$$$RRRRRRRRRR
AAAAAAA$$$AHAA$$$$RRRRRRRR
AAAAAAARRRR$$$$$$$RRRRRRRR
```

Appendix E

Results of Analysis of Ground Truth

These data are presented, as with the other apprndices, separately for phase I and phase II. Within each of these the results of the program BLKFND, the pixels which are not on the boundary of a set of pixels of the same land cover class, are indicated by "1", the remaining pixels by "0". The second set of grids show the pixels chosen by DIFIND as being available for the training of pixels in the DIFFUSE method. Thus the appendix is organized as follows:

PHASE ONE - BLKFND

FTIZSIMMONS 1-4

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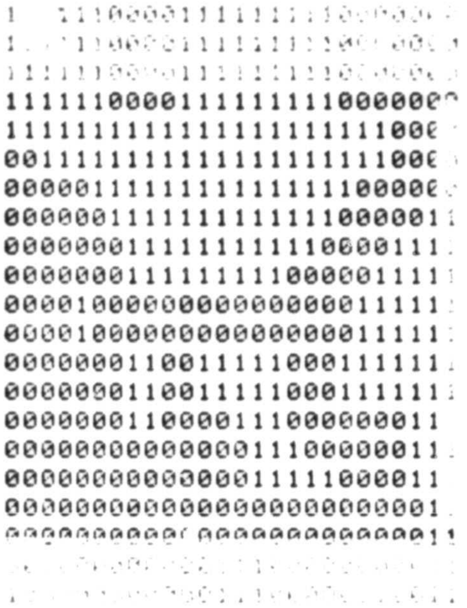

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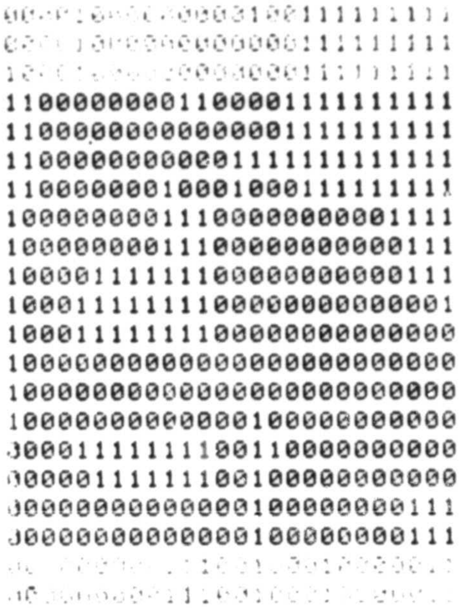

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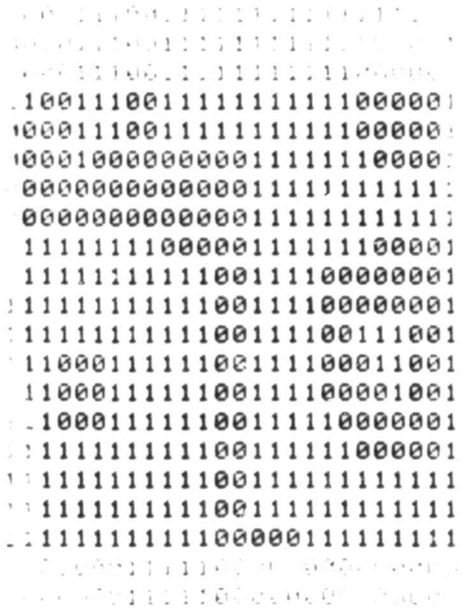

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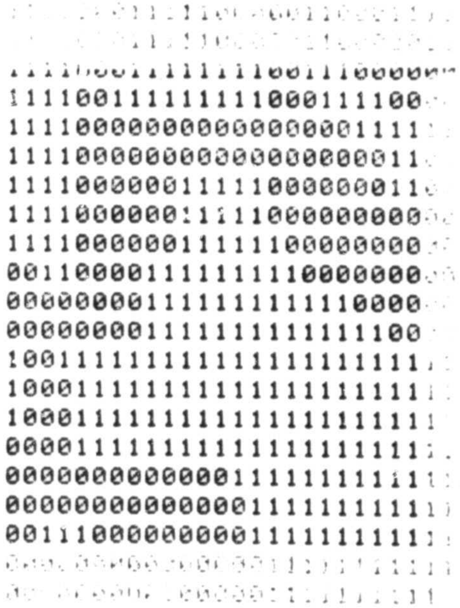

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FITZSIMMONS 5-8

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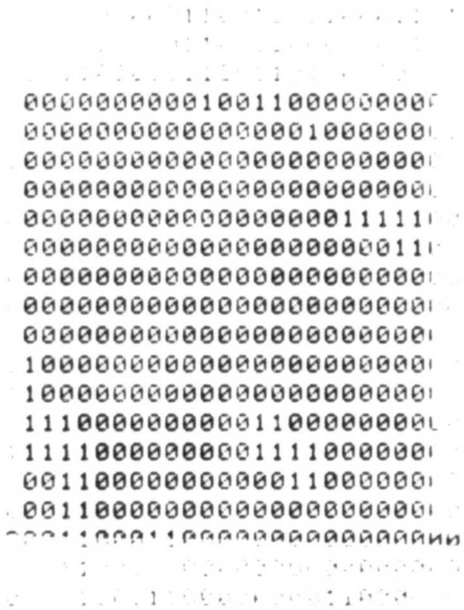

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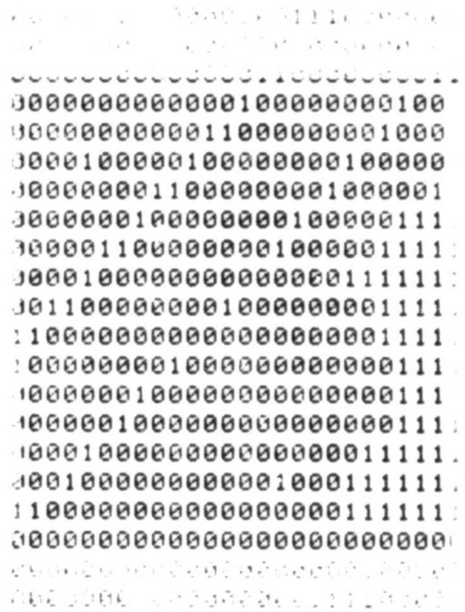

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FITZSIMMONS 9

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0000000000011000000111111
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1111000001111100000111111
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111000000000110000001111
111000000000000000001111
111000100000000010011111
110001100010000000001111
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000000111000000000001111
000000010000000000011111
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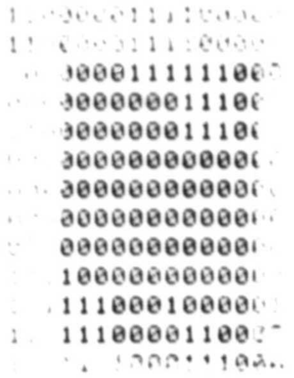

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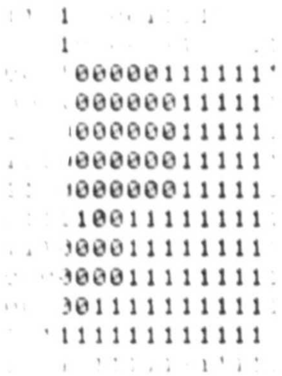

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(5)

(6)

SEVEN PINES 7-12

(7)

(8)

(9)

(10)

(11)

(12)

CHESTERFIELD 1-6

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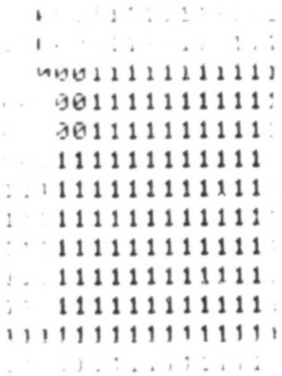
CHESTERIELD 7-12

(7)

(8)

(9)



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PHASE ONE - DIFIND

FITZSIMMONS 1-4

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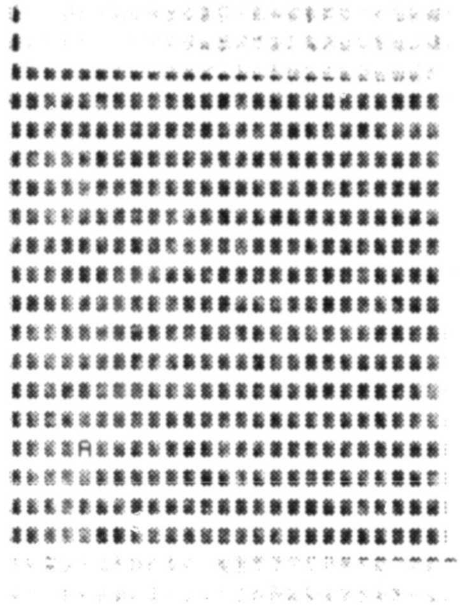

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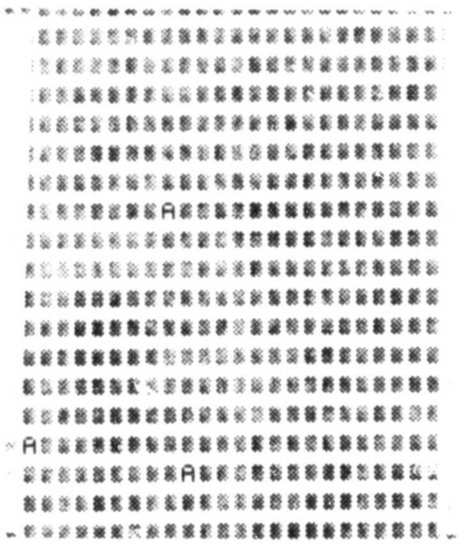

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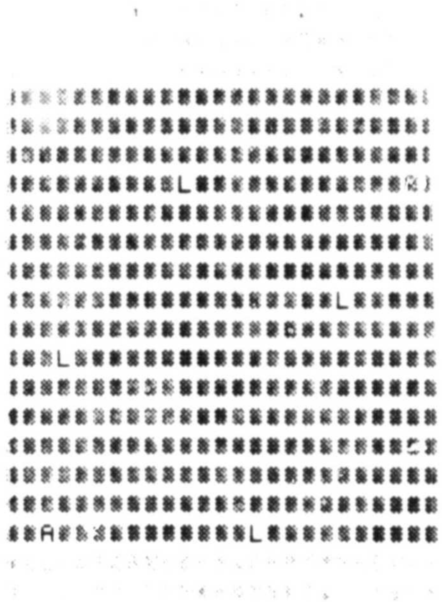

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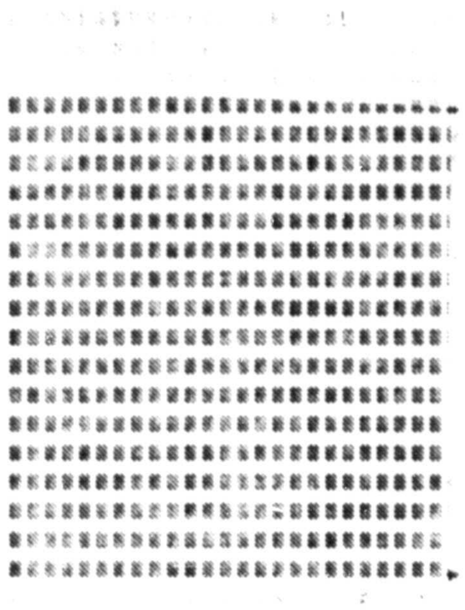

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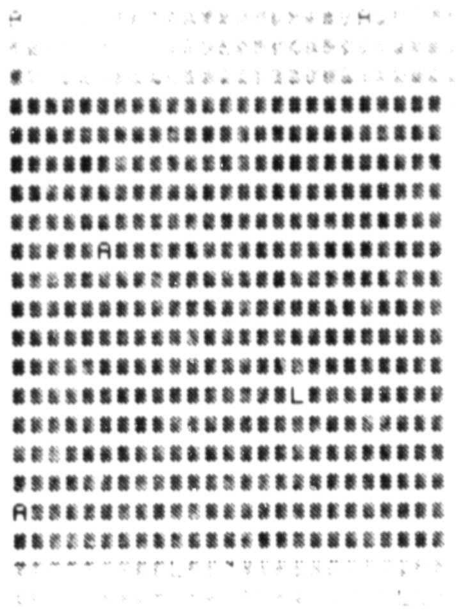

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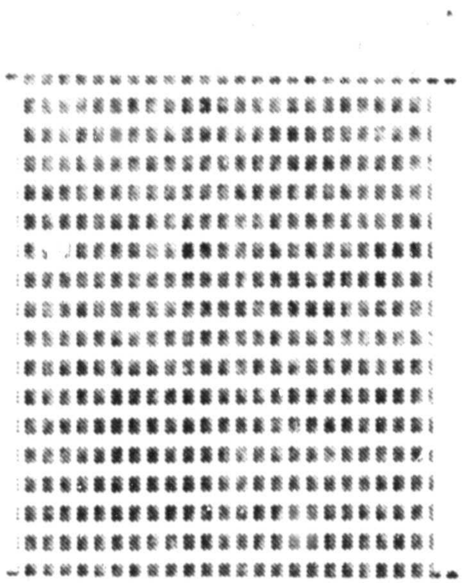

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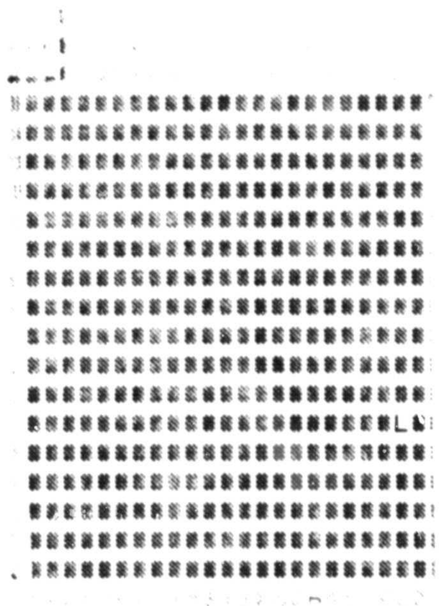

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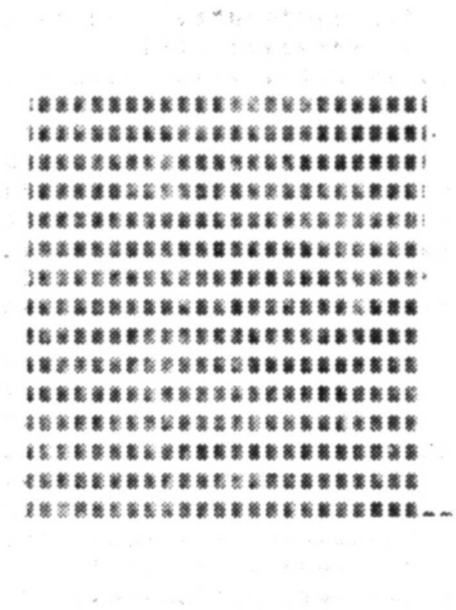
FITZSIMMONS 9



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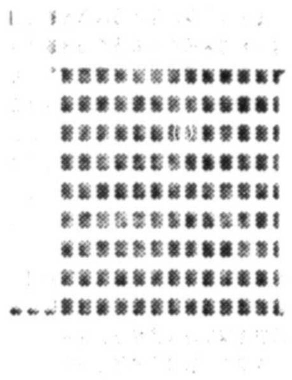

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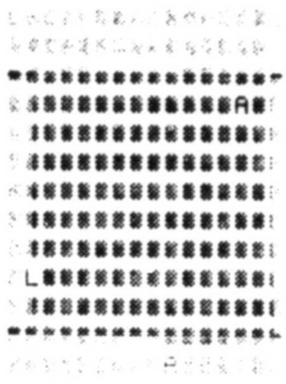

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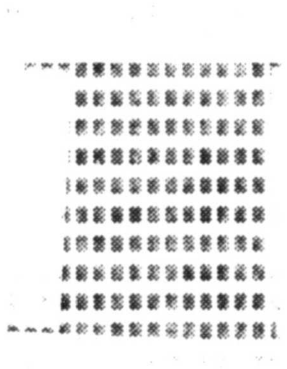
(3)



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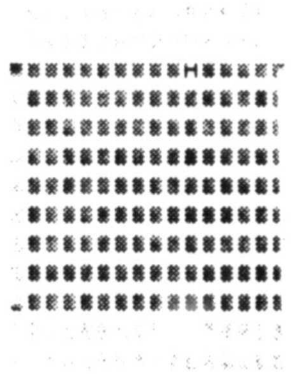

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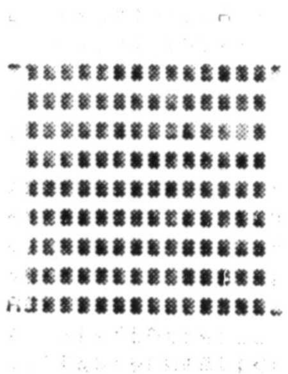

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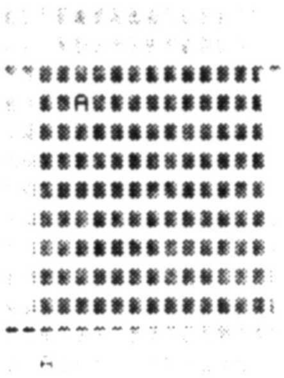
SEVEN PINES 7-12



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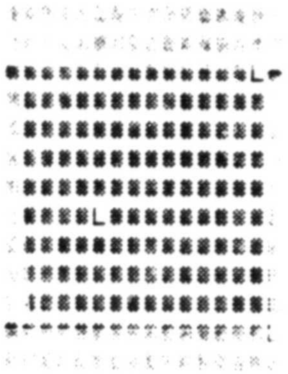

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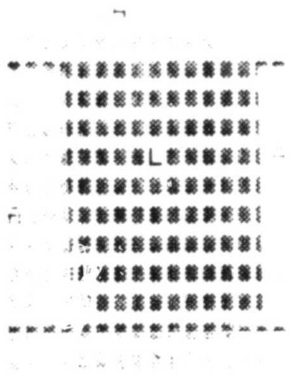

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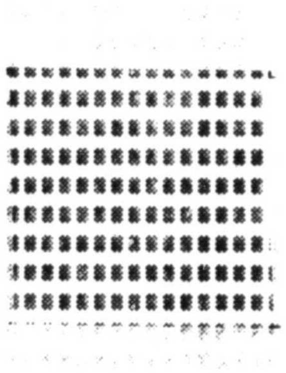

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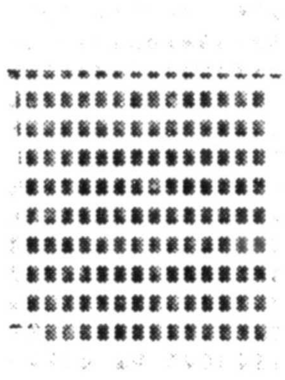

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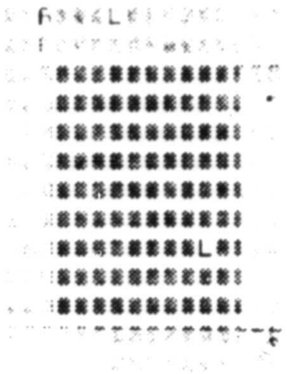

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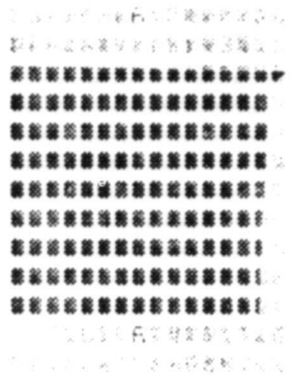

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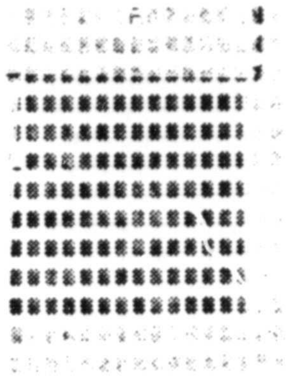

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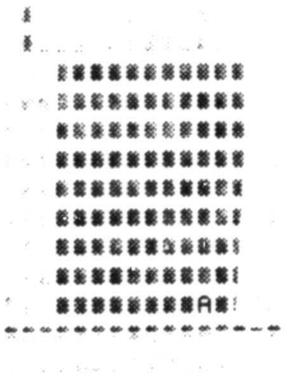

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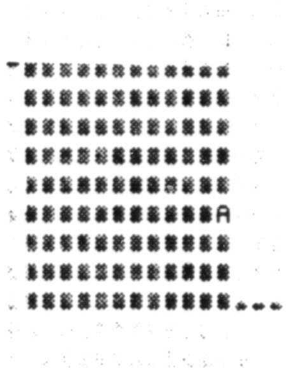

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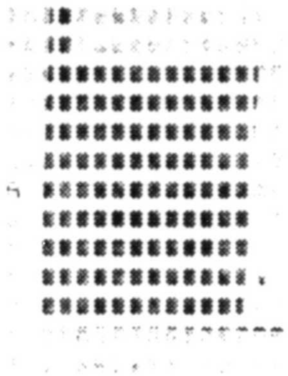

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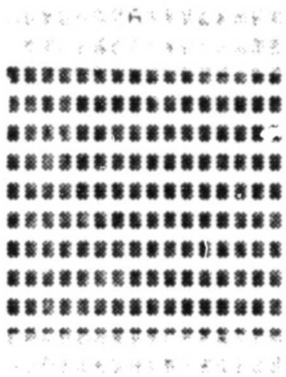

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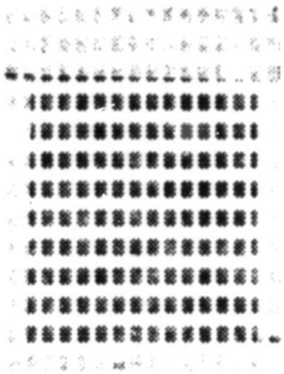

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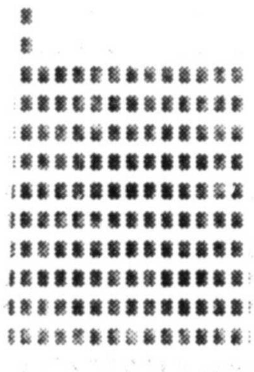

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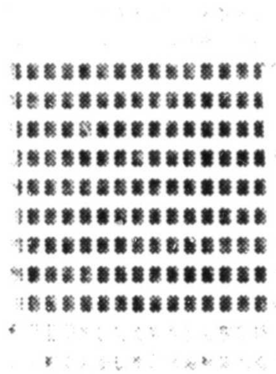

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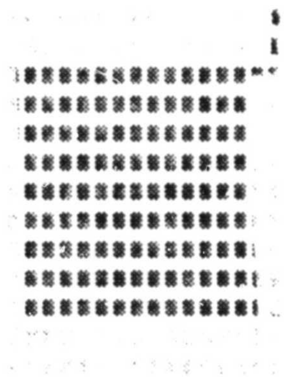

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PHASE TWO - BLKFND

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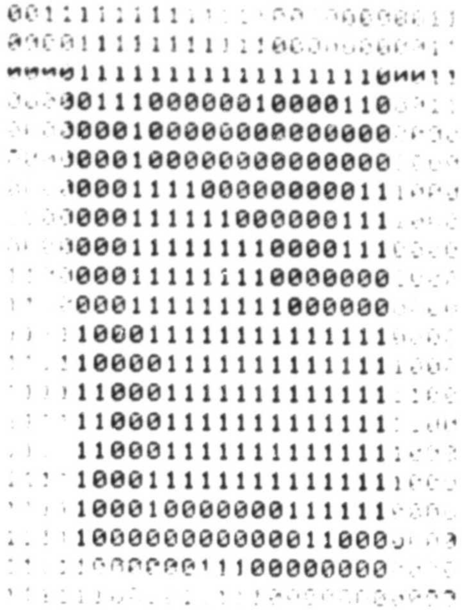

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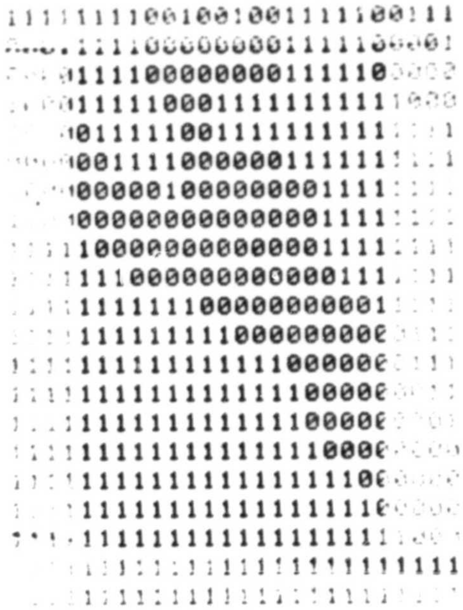

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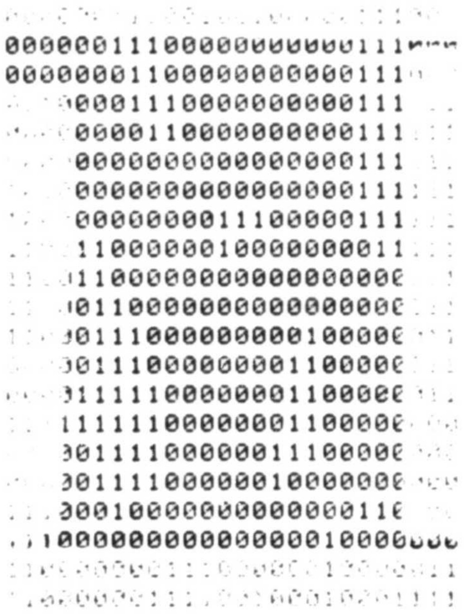

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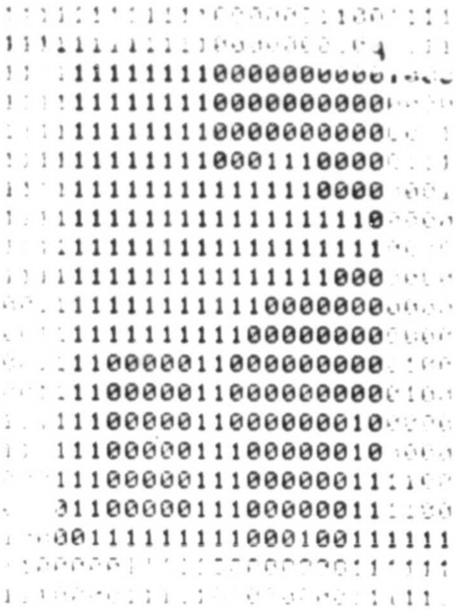

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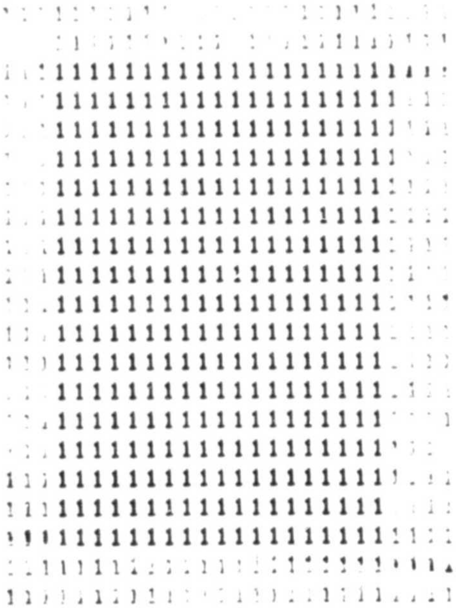

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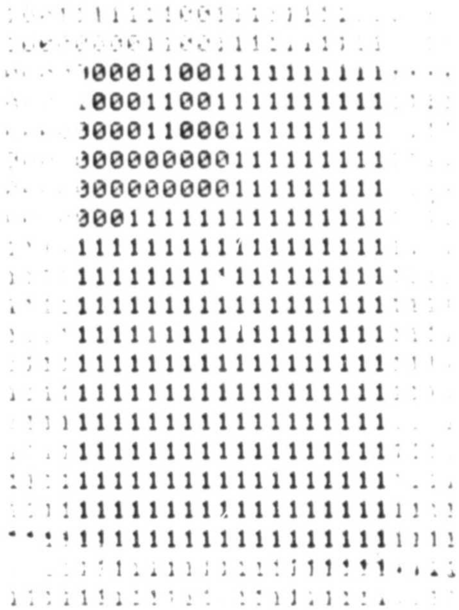

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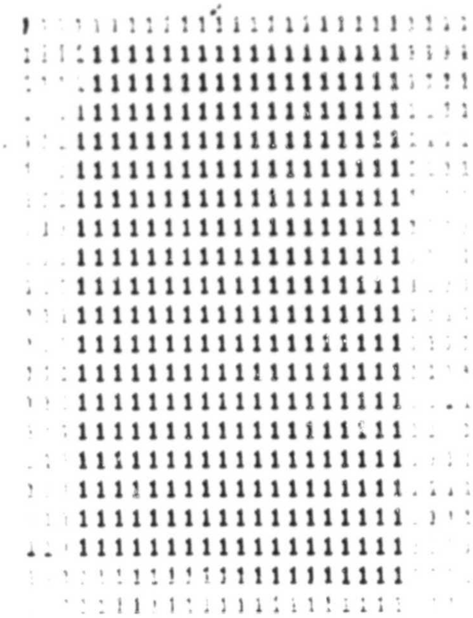

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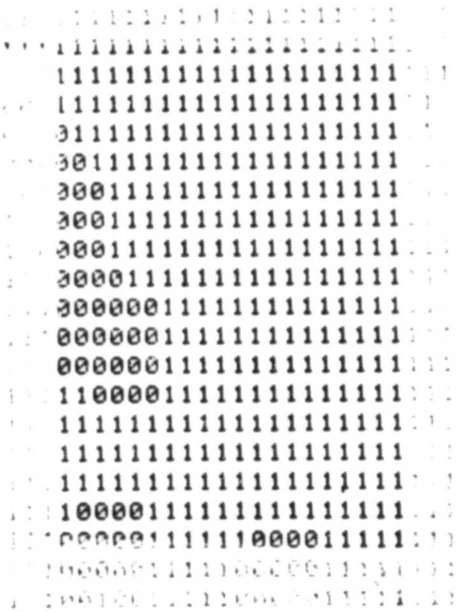

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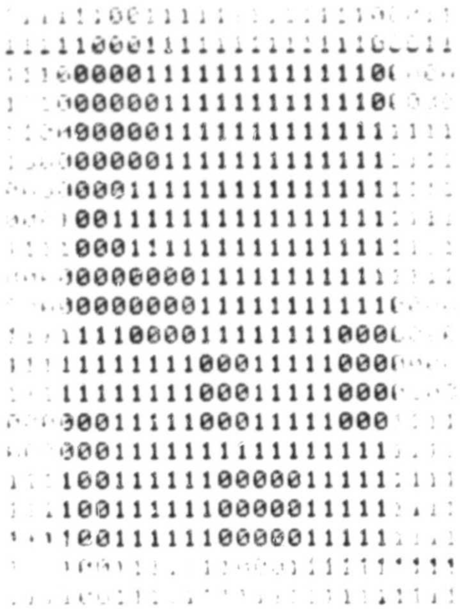

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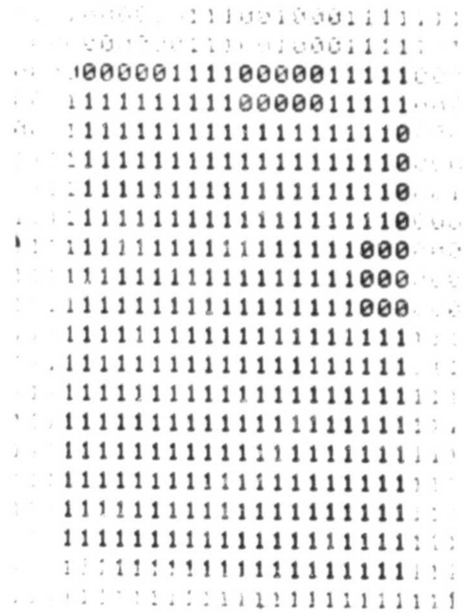

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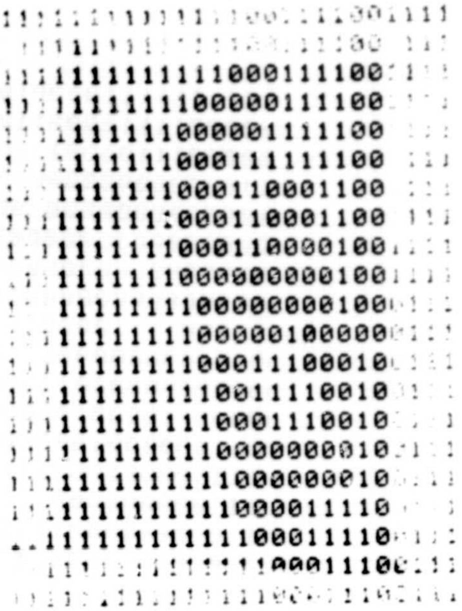

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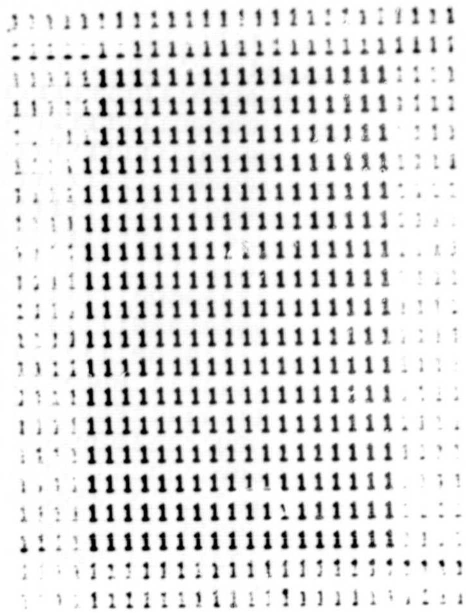

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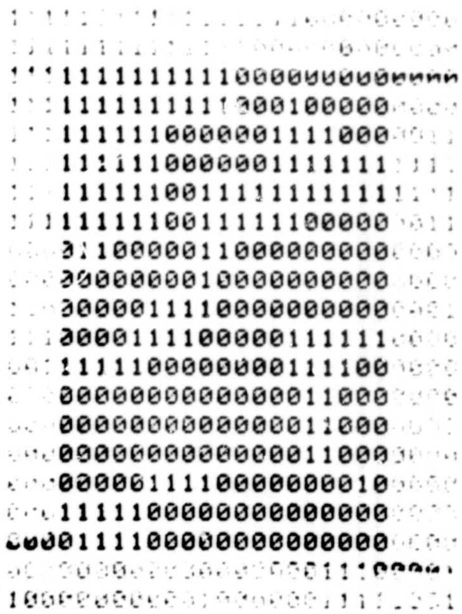

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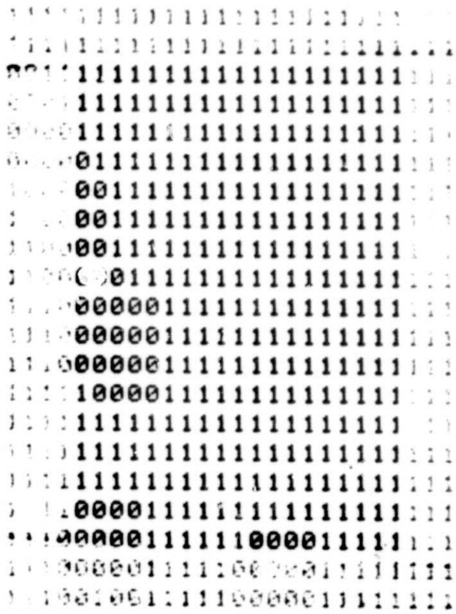

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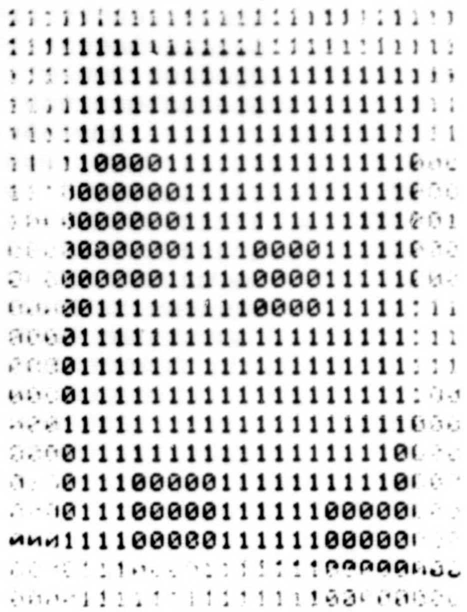

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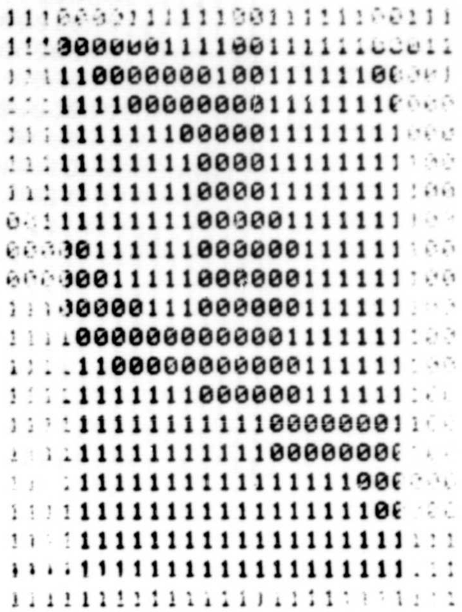

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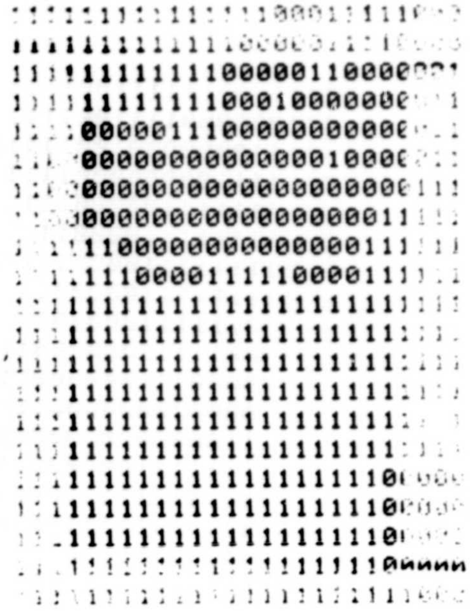

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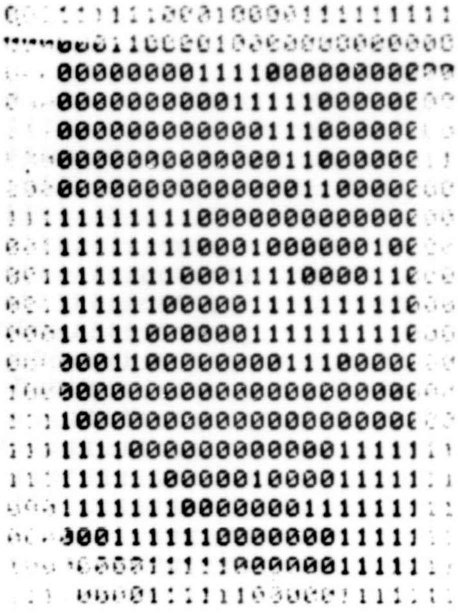

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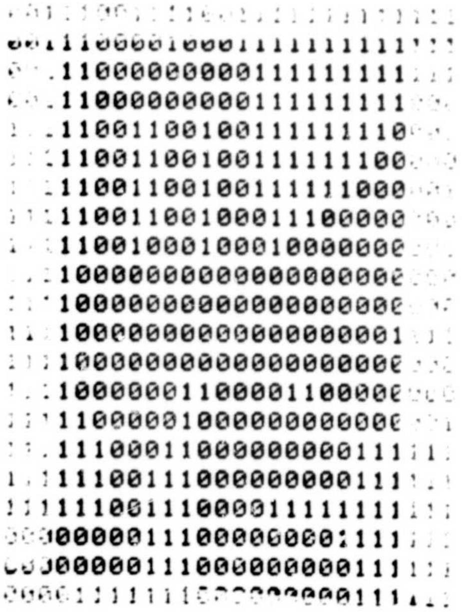

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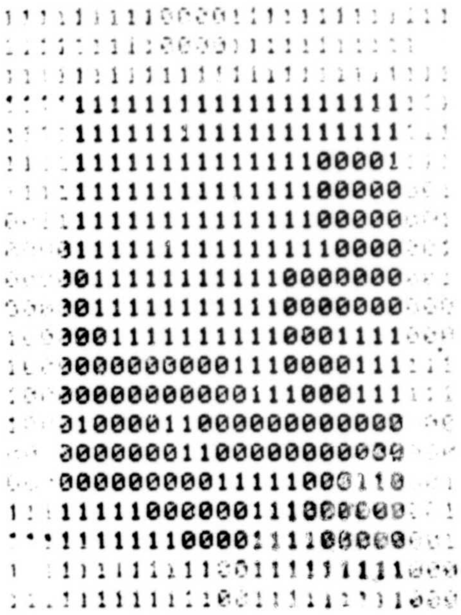

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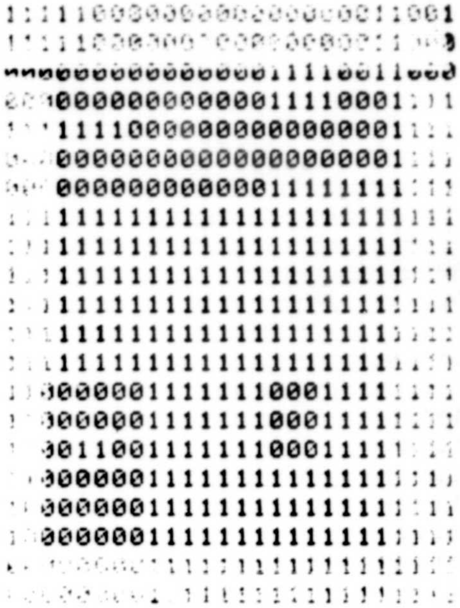

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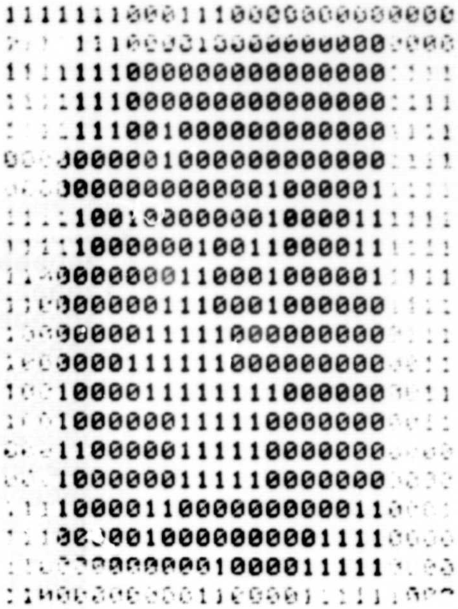

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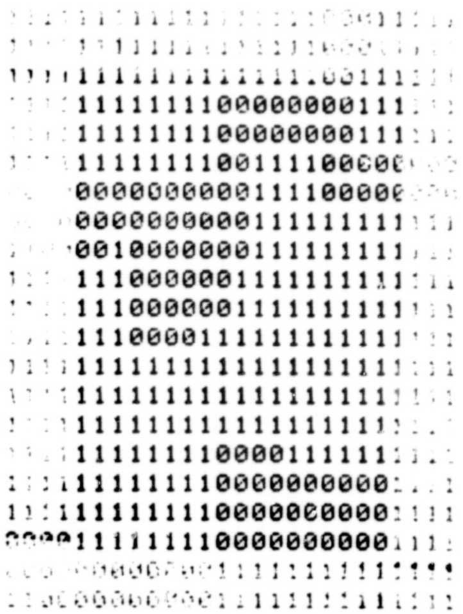

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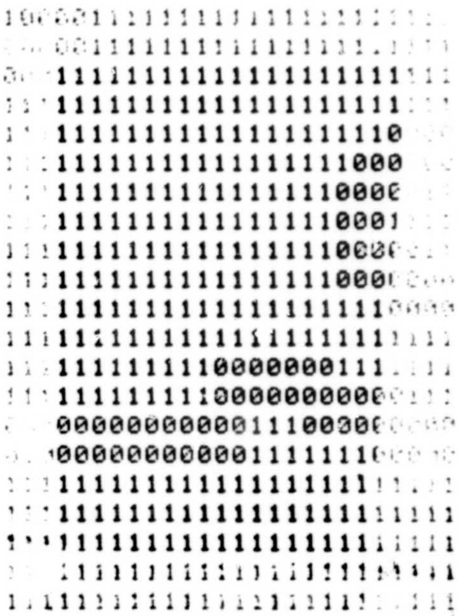

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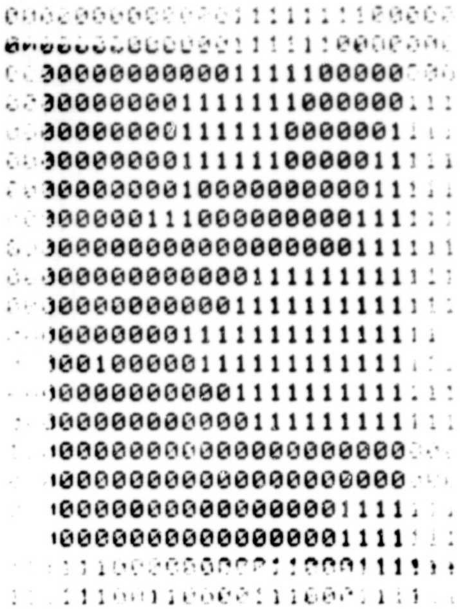

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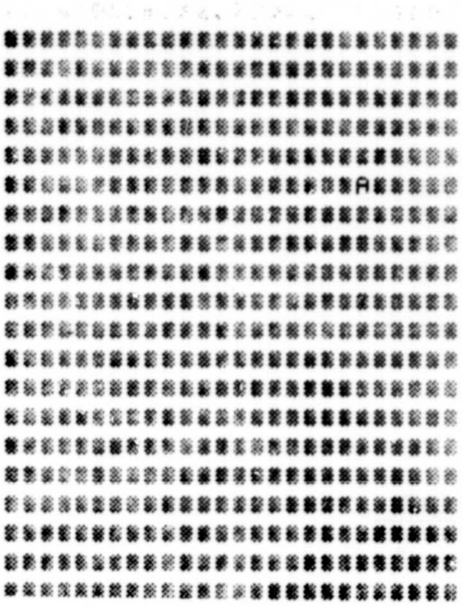

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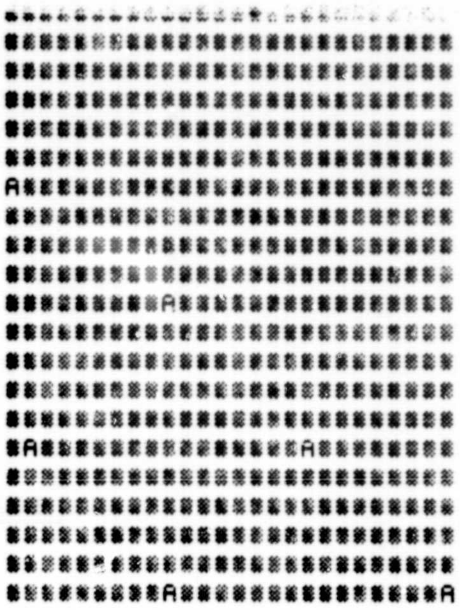

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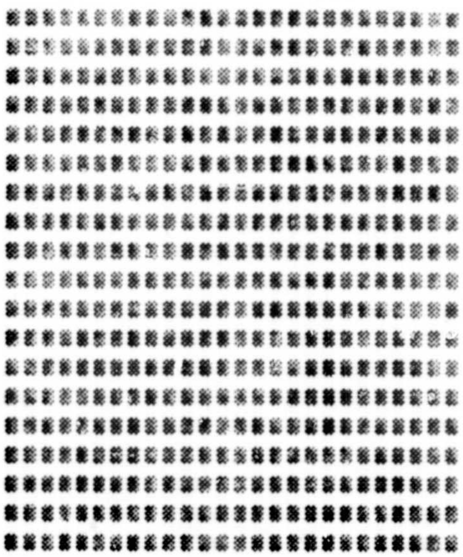

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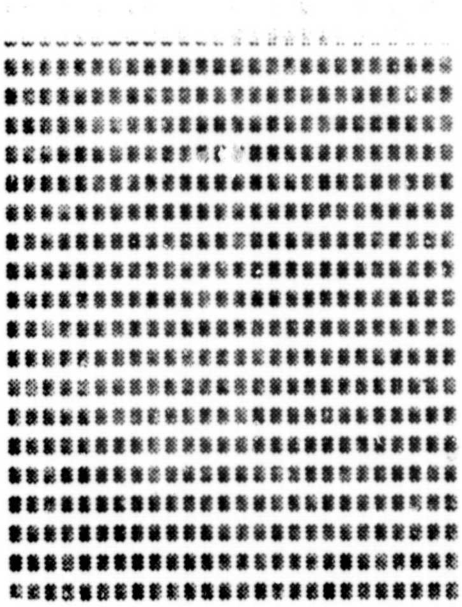

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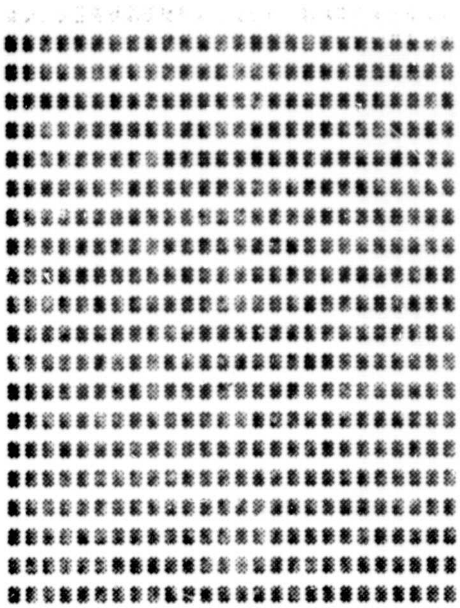

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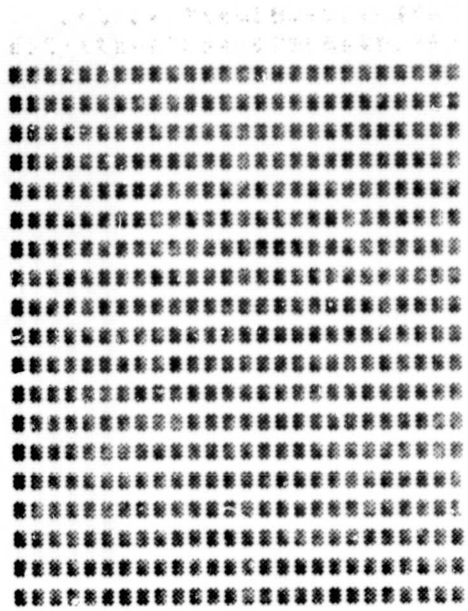

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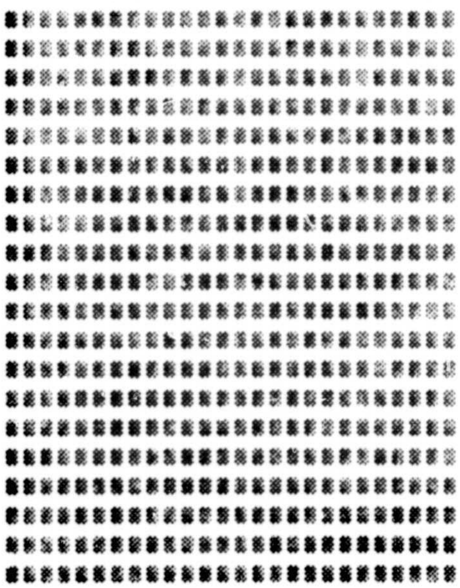

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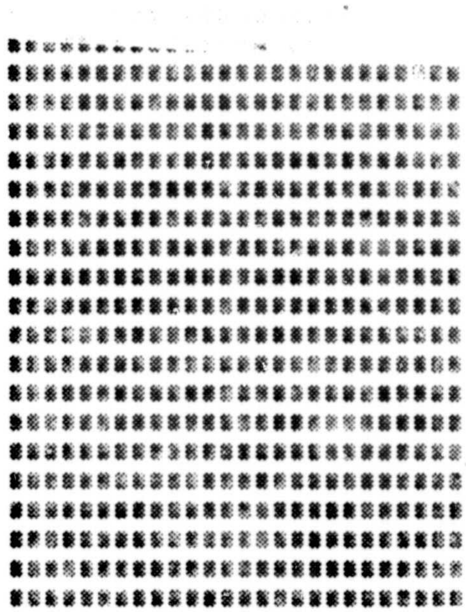

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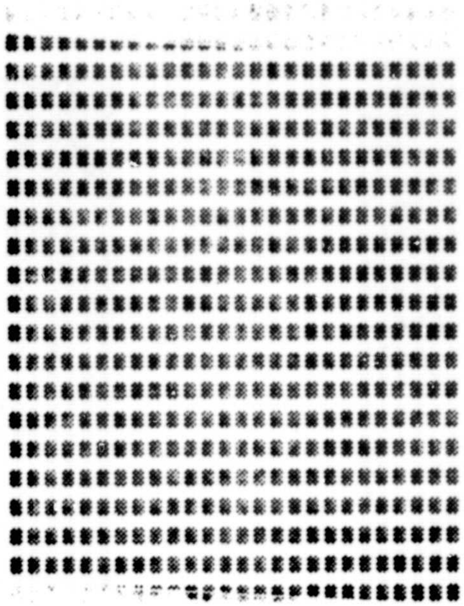

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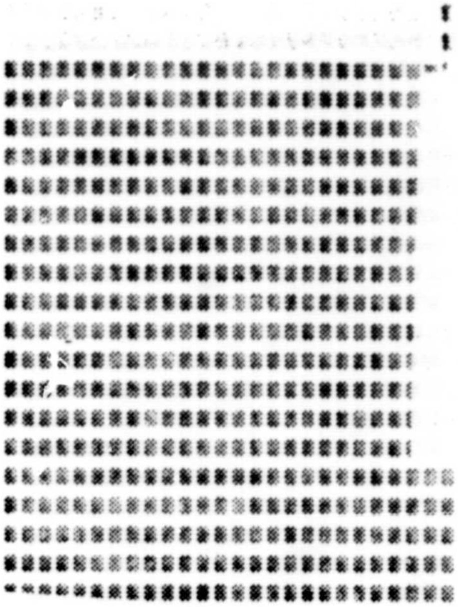

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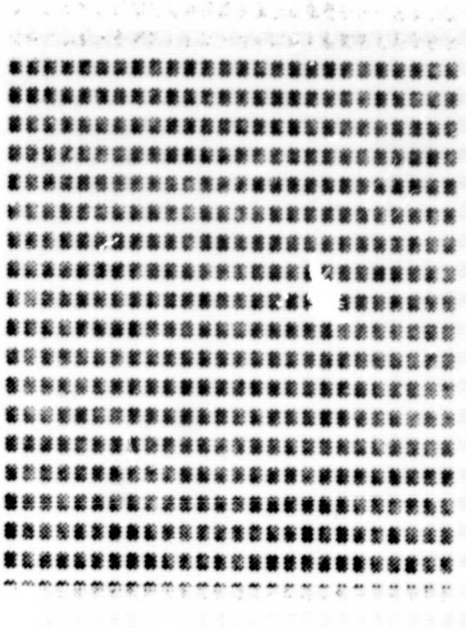

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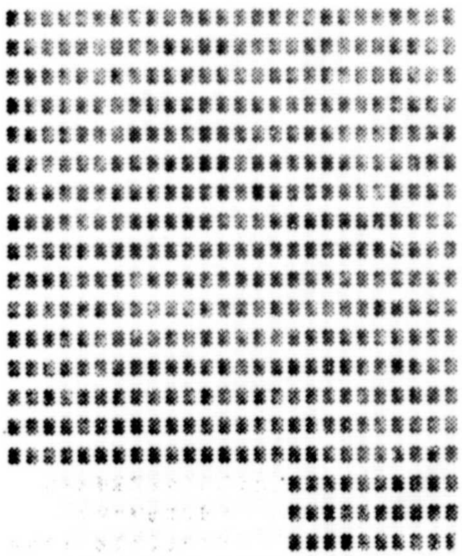

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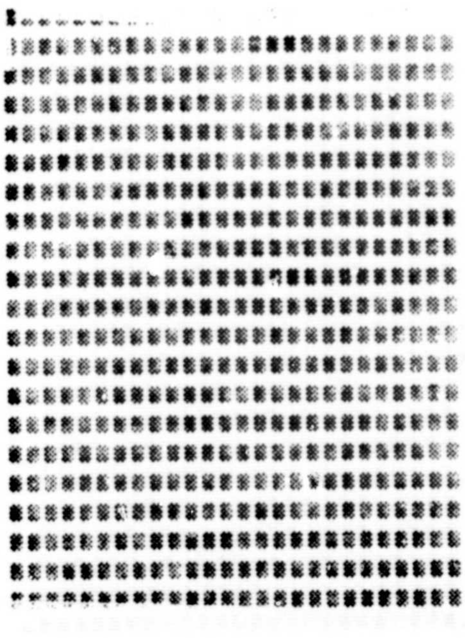

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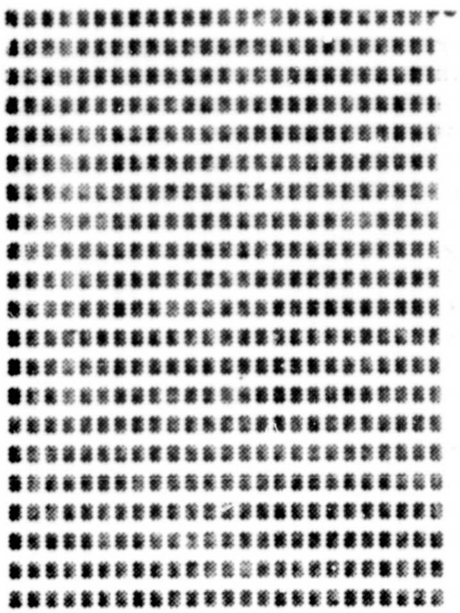

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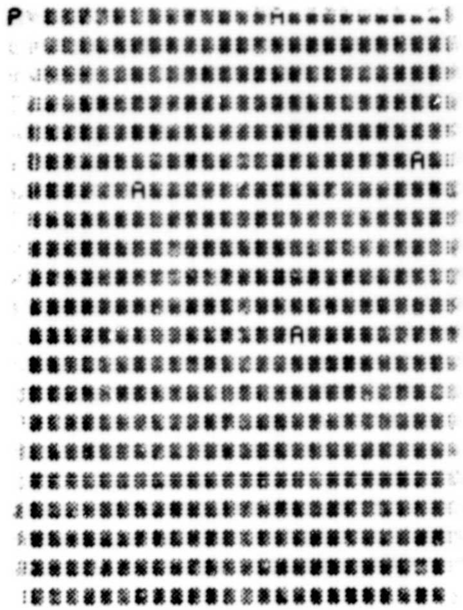

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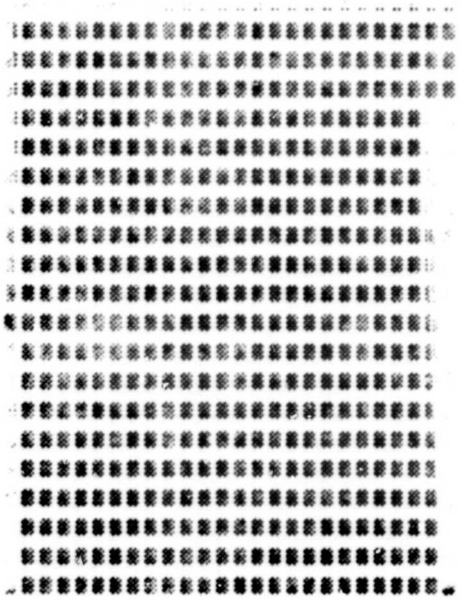

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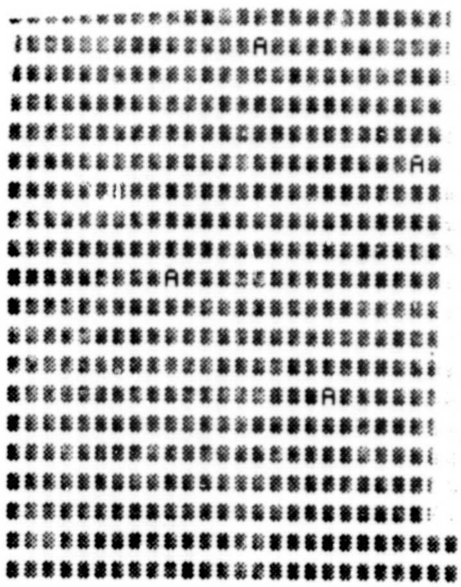

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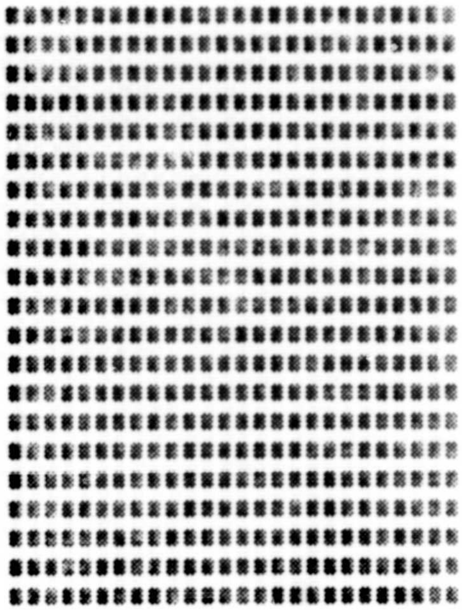

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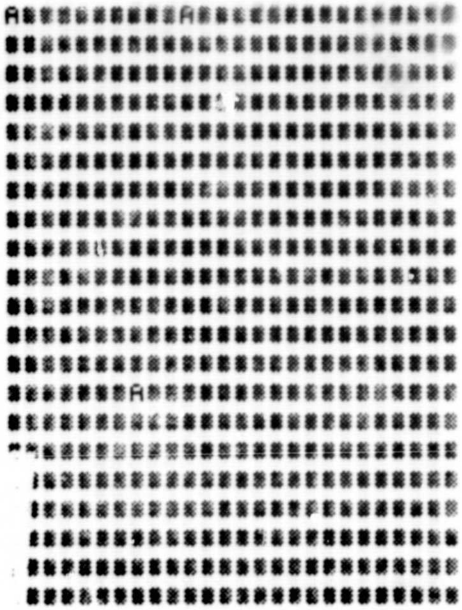

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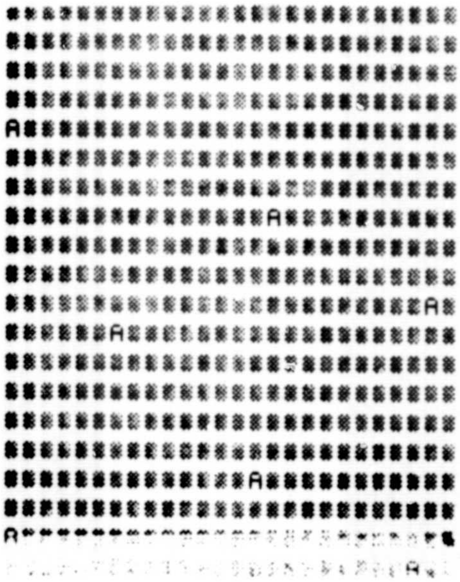

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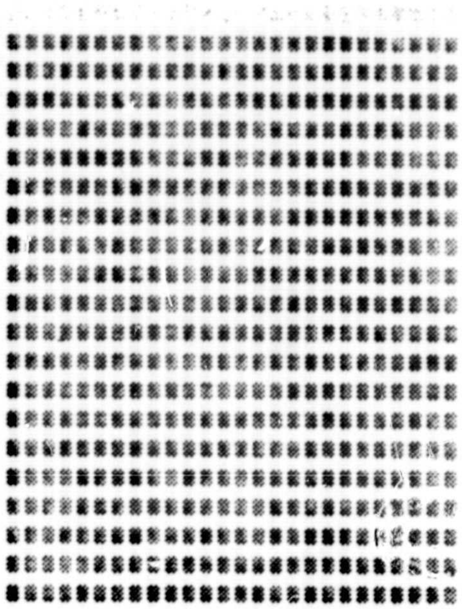

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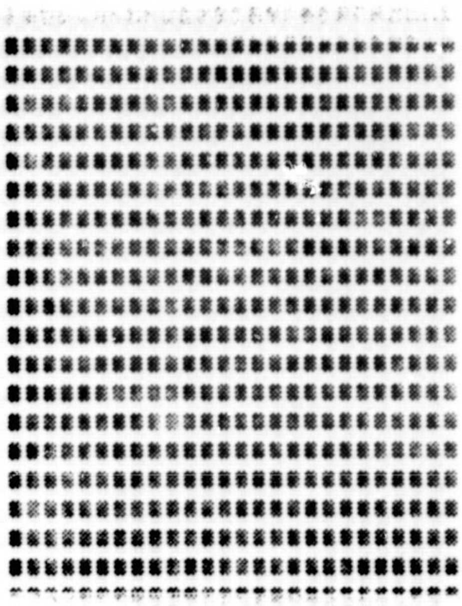

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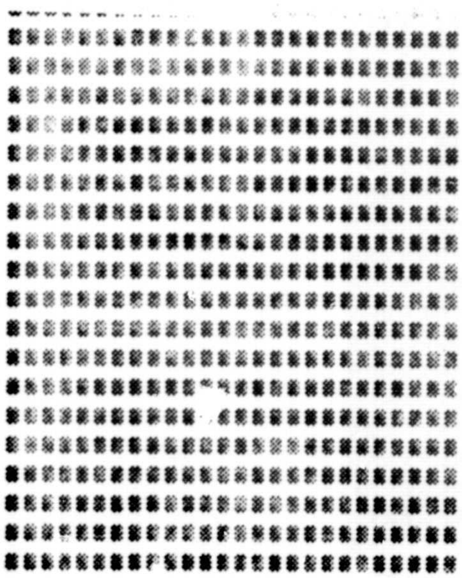

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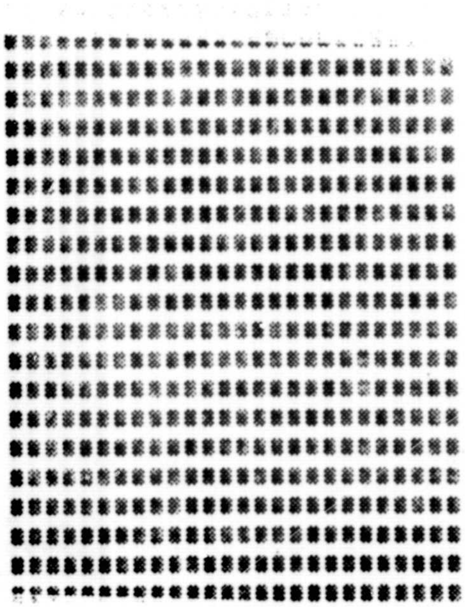

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EAST LAKE 5-6

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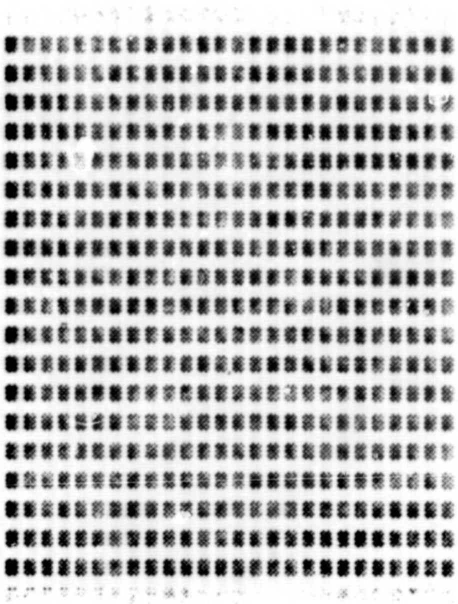

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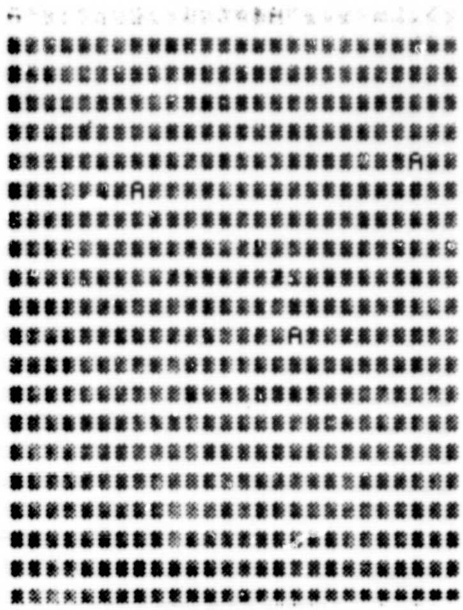
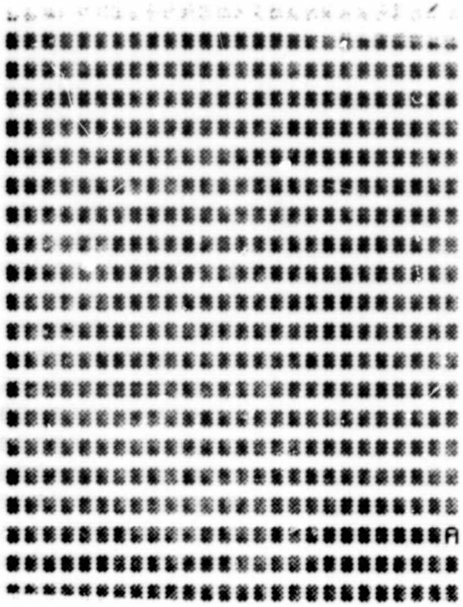


(6)

LITTLETON 1-4



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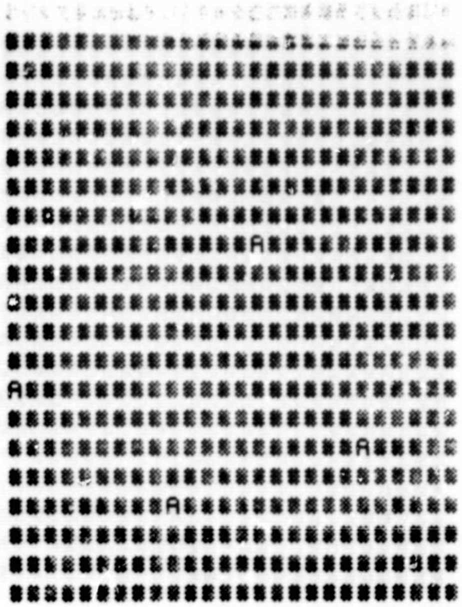
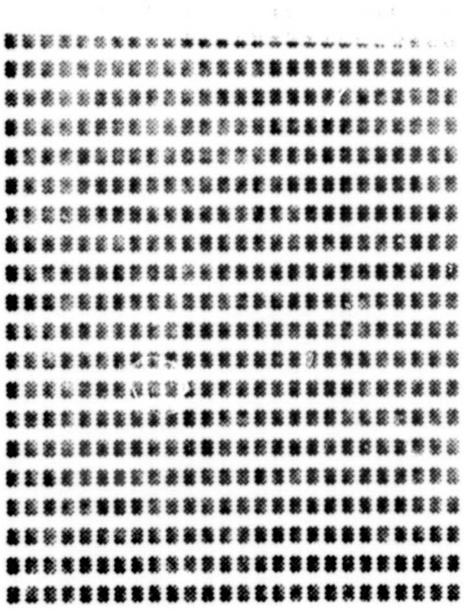
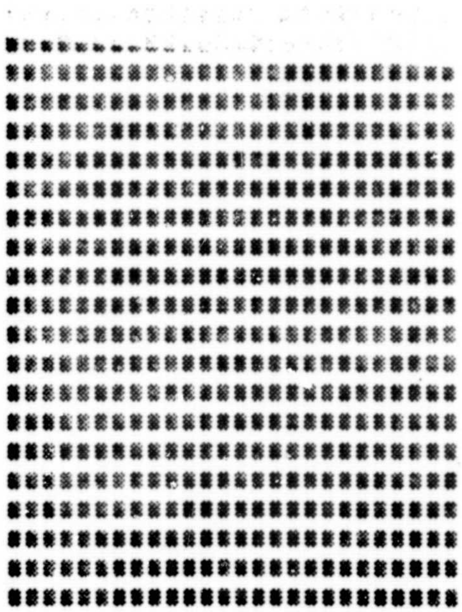


(2)



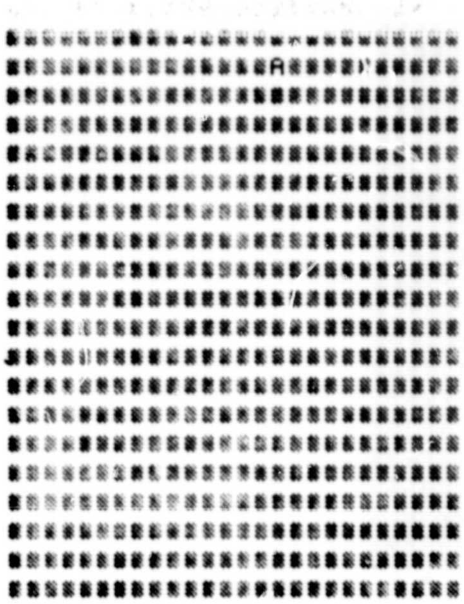
(3)



(4)

C-4

LITTLETON 5-8



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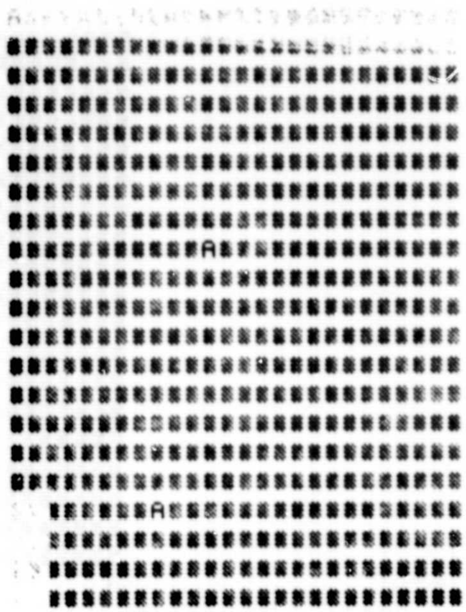

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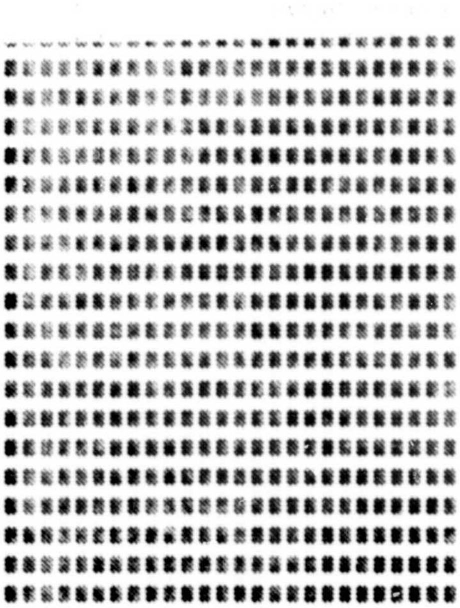

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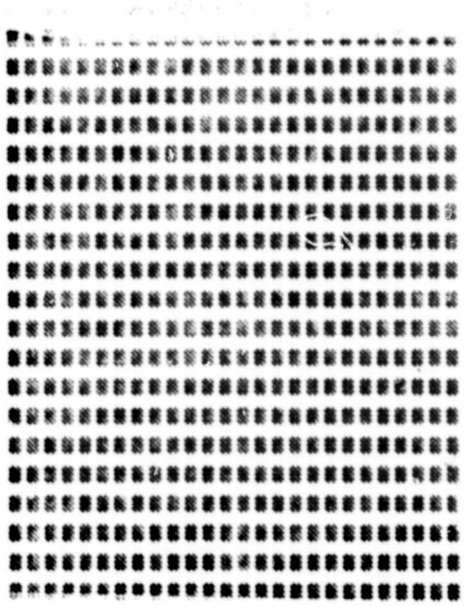
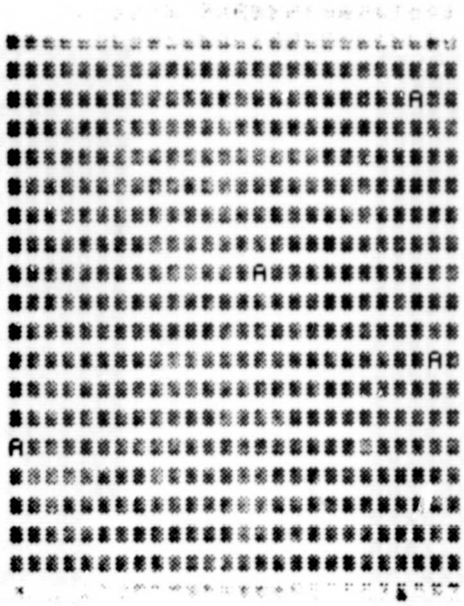


(8)

LITTLETON 9



(9)

Appendix F

Results of PPD

The data which follow are the grids of symbols representing the classification decisions obtained using PPD and the signatures developed using the DIFFUSE and BLOCKED techniques. They are presented in the following order:

PHASE ONE - BLOCKED

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FILE: LDB1

```
 RRRRR AR R RR
RR  R RR     R
R  RR RR
   R  RRRR R
R    R    RR             R
 RRRRRR RRRR
   ARRRR RRR             A
    R R  RRR          R  A
A     R  RR    R         A
  A    AAC  R           R
   CCR  RA        R
      R  R  R R  RR
      R  CCC     RRRR
A       CAA     RRRR R
 CRCCA        RAACCC  R
   R RR  CA   AA AAA
        RA     AA   C
       RCA      A    AC R
RRRR   AC        A   CR R
  A                 AAR A
      RR       RR     RRR
```

FILE: LDB2

```
   AAAA     A C    AAA
 AA A       AAC    AA
            A AAAA  AA
       A    A  A      A
    A           A
             AA A  CACA
                A    AA
A           R
C         AAAC        CC
AA             R    R  A
     AACA    A R  A R  A
AA   CCCCCAAAA          A
A   AAARRCAAAA   R    A
A   CCAAAAAAAAAAC   ARR
AAAARCAAAAACAAC C   C RCCA
AAA ACA RCC AA   A  A   C
A   AA  CAARA     AAAAAAA
    AAAAACCCA       A  A
    AA    CAA          A
 A  AA    AA AA       AA
  AA      C  AA     A AAAA
```

FILE: LDB3

```
 A  AAAAA AA            C A
    AAAA  A A            C
    ACCA  A           A C A
AAA RAAAA CCC         AAACC
A ACCA AARRRA A        A AC
A  A  AAAACCC A A ACCAA CC
C AA  AAAAAAAA  ACRRCACCRR
C     AAAAAAA AAC         A
A    AAAACAAA  AA       AAA
A A  AAACAAAA   C      AAAA
AAAAAAAAAAAAA  CR   AC   RC
AAAC AAACAACCAAC         RA
AAAAA AAAACCAAAAC         C
CAAAAAAAAAAC  A C         C
AAACA AAACR   AA AAAAAAA  A
  ACAAACCACC  AA AAAAAAAAA
 AAAAACCAAAAR  CA A  AA AC
 AA AAAAACCACR CCAAC A A C
A       AAAAARR CCCAACCCCC
        CACCRRRRCRR AACRRR
C     RRCRRRRR  R   RR
```

FILE: LDB4

```
          R  A
       C  CC CA A R  R
 A        A R  A   RRR
            R       R
              RRRC
     A       R   R RA    R
         R          A   RR
     ARRR           A   RR
     A              RA  RR
    ARC          R  RAAACR
 A  AA   RR  RR      RRCCC
 A   R   RR R R   RR RRRRR
 R   RR       RR   R   R
 CR  RRRR RR   R    RR
 R    R   RR  R  R
C                  RR
  R R   RR            R
  CAARR      R RR RR R
 A  AAC        RR   RR R
      RA R CA       R  R
  A   CR         R  RRA
```

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FILE: LDI5

```
A AAAACA     ARAAAACRRRCCA
    AA   C CA AAAARCRR RRCC
     CAAAA ACC   RRRRRR AA
         RR     AAA      AA
    RRA  RR   A A AA AA  A
  A   RCCRR  R    AA CAA A
  AR   C RR       RRR A
  ACA        A
     A       AA
A    CAR     AC          R
 CCCCACRAA
     RRCC C
     AAC   CA        A A
   ACC A    A        RACA
   ACCCC             RC A
     A                   A
     AAA                C
     ACAC               AR
  A A      A R     A   AAA
  A        A C    C
A AC       A AA CCA
```

FILE: LDB6

```
ACARCCCA  CRRRC    A
AAAAAAAA ACR RRRRCCC
AA AAAAAAARRR RRR CCCA AA
 A AAAAAAACR  CRCACCCCCCAA
A AAAAAAAACRA A    A ACC C
A ACCAC A  A
AAAACCC    RCC       AA
AA AAAARRR RRR     A AA
AC CAAAACRRRRR    R C
AAAAC AACR RR RRAARRRR
ACAAA  ARR RRRRAAAA A
CRAA A  RRRRR  RRACA
A RA AACRRRRR   RRRRRAA
A  CCC R  R RR R RRAAAA
   CCRRR R  RC   RR   AA
A  A ACRRRRRACRRRRCRA A A
 A A  A  CCAARCRRRRA AAA
  A       RR  A  RA   AAA
A       ARRRAAAA    R AAAA
       ACA R      AA AAAA
 AAAACRARRC      RRCAAAAAC
```

FILE: LDI7

```
    A
A  A
 AAA                     R
A   A
A     AA
    C A A  A         R
         CCA
 A          A
 A        AA A           A
CRAA                   AAA
CRA C         A  A    A
C RAAC      AAAACCR   AAA
 ARC        AA
ACA A                A
A ACRARRAA
CACCRRRR   RAA       A ACA
CCCC AA     RR        AAA
RRRRA        CAA    A
 RAC         A ARA     A
    RR       AAAA
```

FILE: LDB8

```
  RR AACRCC C      A
   C  A  A     A
     C        A
R
          R
   A ACA                 R
      CA      A          R
     RA                 R
   CA      R          R  R
   AAA   AA        R RRRRR
  AAAA  A        R RCCRR R
AA   A C       A RRR  RRRR
    AAR       A  CR    RRR
    CC        A         RR
 C            AA A   RRRR
         A  A     C CCRRRR
       ARC  C  R   R R  R
       CAR   RAC  CRCR RRR
      R  AA   CCARR   RRRC
            ACCC  RC    AC
AAA        RA    CC
```

FILE: LDB9

```
A AA              A  AAACC
R A  A   A      R RA ACA C
RAA R         AAA A  A   A
  ACCAAAAA    ACCAAA CA
 CRRRRAA      RCCCRA  A
    RRR    CCAAACRC    AA
R     R      ACCC AA  AA
R  RRR  R     CA  AA  A
R  R R  R   CA AA A  AAAAA
    R   C    AAAAA C   AAA
  RRR  R    CAAAAA  A  AAA
    RRRR    AAC    C   AAA
R           RCCR R C    AA
R    RAAC           A  AAA
       C ACCAA     A    AA
      C    AC
   RRR     AAA
R  RRRR     CCRC       AAA
     A                  AC
R   AA          CC     AAC
R AAAAA        AA  C  AAAA
```

FILE: LRPB1

```
R  A        RCC
        C  CA
        C AR
 AA     C  RC
 C  ACAC CRRC
     RCC   R A
 RRRC   R   CA
RRRRRRRRRR  CCR
RCRCR  R    CCR
CCCCC         RR
CCCCR RR R R  RR
CRCCRCRRRR    RR
R ACRCRRR   RR
```

FILE: LRPB2

```
R  RCR   RRR   R
C   CRRR R
R  AC  R
CCC     R
CCRRRRRR    A
       R    ACC
R  RR R  RC CCCC
   RC CRRR  AA
 RRRCCR RRC  CCR
RRRRRCCRRR
R RCRR       C
A RC         R R
 CAC        RR
```

FILE: LRPB3

```
RRRRRRRR RRRRRR
ACRR RR R  RR
ACR        RR
CR       RRRRR
ACRRR RRRRR   RR
CRRRRCA  RR   R
RRRR     C   R
R  R    CRR R  C
   RR    CR    C
  RR  RRCC  RR
    RR RRRR  RCC
  R  R RCARRRR R
  R    R RRRRCRR
```

FILE: LRPB4

```
 RRR
         R  RR
          RRRRRR
   RR         RR
  R R          R
  RR       R

              R
      R  RR   R
      R  R  R
    RR RR    R
       R   RRRR
      RR   R   R
```

FILE: LRPB5

```
CRRC A  A RRC
 R      RCCCC R
         ACRCARR
         ACRRA R
            R RR
             RRR
         AA
 RRRR
    RRR   R    R
    RRCRRRR
RRRRRRRRCRR    R
   R R RRRRRRR
   R     R  RRR
```

FILE: LRPB6

```
RRRCCCRRR RRR  A
 RRRRR RRRC   CC
R RRR  RR RA  RR
  RRRRRRR  A ACR
 RRRR     RRRR
RRRRR  R  R RR
RRRRR     R R
 RRR  R  CRR
RRR   RA  R  RR
RRR RRA    CR
CRR        CRRR
CCA  AA R
CCACCRRR
```

FILE: LRPB7

```
     R        R
 R RRRR   CC  RR
RPRRRRRRRRRRRRRR
    RRR RR RRRRR
  RR       RRRRR
RR RR   RRRRRRRR
 RC R    RRRRRRR
  CRR    R RRRRR
 C       R RRCRR
CC   RR RCARRRCC
RC R       CRRCC
RRCRRRR     CCRR
RRRRRR        RR
```

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FILE: LRPB8

```
RRRRCCR
RRRRRRR    RRR
RRRRRR  RRRRRRRR
RRRRRRRRRRCCCRR
RRRRRRRRRRRRRRR
RRRRRRCCCCCRRRRR
RRRRCRCCRRRCRRRR
RRRRRRRRR RC   R
RR RRC RRRRCRRRR
RRRRRRRRRRRR RR
RRRRRRRRRRRRRRRR
 CRRRRCRRRRRRRRR
   CRRRRRRRR RRR
```

FILE: LRPB9

```
    RR    RRR
    R
R   R
   RR
   RR     R
RRRRR     RRR
   RR RRRR
RRR RR   R
R R  R
RR  RRRR
RRRRRRRRRR
RCRRRRR R  RRR R
   PRRR   R RRRR
```

FILE: LRPB10

```
CCCR  RRRRCR
RCRRR  RRRRRRC
 RR RRRRRRRRC R
RRRR RRRCCRCCRR
CACRRRRRCCRRCRR
CCCRRRRRCCCRCCCR
CCCRRRRRCCCRRRRR
   RRRRRRCRRRR R
C RRRCRRCCR   R
R  RRRRRCCR   R
RRCRRRRRRRRR   R
RRRRRCCCRRRR
CRRRRRCRRR RR RR
```

FILE: LRPB12

```
 RRRRR   R RR RR
   R R     RRRR
      R  RR RRC
RRRR        RRRR
RCRR    R  RRRRR
   CCCCCC  RRR R
RR R   R RRRRRRR
RR            CR
 R R RRR       A
R      R  R  R
RR     R       R
R      RR
     R
```

FILE: LRPB11

```
CCRRRCCRC  CCCCC
RRRRCRRRRRCRR RR
RRRRRC RRRRRRR R
RRRRCRR R   R  R
  RCC      RRR
    C     RRR RR
 R RC        R
 RRRR    R RR
 RRRRRRR  RCRR
R  CRR   RRRRR R
RRRRR  RRRRRA
RRRRRRRRRCCCCCCR
RRRRR RRCC C RRR
```

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FILE: LRCB1

```
 ----------------
|CRRRRRR         |
|CRRCRRR RRR     |
|RCCCRRRRRRR   RR|
|R  RRRRR R   R  |
|    RR CRRR    R|
|    RRRRRRR   R |
|   R     RR  RRR|
| R CCRRR  RR RR |
| R   RRR R     R|
|  R RRRRRRR     |
|R RRRRRRRR      |
|  RRRRRRRRRRRRR |
|R  RRRR    RRRR |
 ----------------
```

FILE: LRCB2

```
 ----------------
|   R  R   RRRRR|
|  R   RRRRRRCCC|
| R    RR R   CC|
| R ,  RRRR    C|
|      RR       |
|   RRC         |
|   RR         R|
|R RRR R R  RRRRR|
| R C  RRRRRR  R|
|RRRRRR    RR   |
|RRR RR R  R    |
| RRR RRRRRR    |
| RR RRRRR R    |
 ----------------
```

FILE: LRCB3

```
 ----------------
|RR RRRRR  R RRRR|
|RRRRRRRR  RRR RR|
|CR RRR RRR RR  R|
|C R  RR R  RRR C|
|C RRRRRRRRRRRR  |
|RRRRRRRR RRR RRA|
|RRRRRRCRR RRCRC |
|RRRRRRRR  RC RC |
|R RRRR  RRRCCCR |
|RC R    RRRRCCRR|
|CC  C      RR  R|
|CRCCA      RR   |
|RC           CRR|
 ----------------
```

FILE: LRCB4

```
 ----------------
|                |
|RR              |
|RR              |
|RRR             |
| ARR            |
|CRRR            |
|R R    R      R |
|RR R  R    R RR |
|RRRR  R     R RR|
|C R R        R  |
|R RRR        RRR|
|RRRR R       RR |
|R CR          RR|
 ----------------
```

FILE: LRCB5

```
 ----------------
| R  RRRR RC   RR|
|RR   RRRRR    RR|
| R  R  CCR    RR|
|R      CRR RRRR |
|  RRR R R   RRRR|
| RRRRRRR      R |
|     RRR   R    |
|           RR   |
|        R     R |
| RR R           |
|RCRRR        RRR|
|R RC R          |
|RRRRRR          |
 ----------------
```

FILE: LRCB6

```
 ----------------
| RRR            |
|R  RR        R  |
|                |
| R  R           |
|R    R          |
|  RR RR         |
|RRR  R    RR  RR|
|  R  RR      R  |
|R RRRRR  R  RR C|
| RR          R R|
|  CRR    R     R|
| RR    R        |
|             R  |
 ----------------
```

FILE: LRCB7

```
R

        R
      R  R
RR  R RRRR
 RRR C
RRRCRC
RRCRRR      R
R     RRRRRR   R
  A   R RRR RRRR
RCAACR  R RRRRRR
R  CRR RRRR   RR
   RRRRRCRRR RRR
-----------------
```

FILE: LRCB8

```
     RRRRRRRRRR
     RRRR R  R
  RRRRRRRRRR RR
   RRRCRRRRRRRR
 R RRRRRRRR RRR
RRRRRRRRRRR  CR
RRRRRR  RRR RRRR
RRR RRRRR  RR R
   RRRR  RRRRRR
 R   R RRRRRRRRR
    RRRRRRRRRR
      R
      R
-----------------
```

FILE: LRCB9

```
         RR
        RR

   R
RRRRR
RRR       RR
           R
           R
          R   R
  R        R
            CR R
  R R    RRR   R
-----------------
```

FILE: LRCB10

```
-----------------
```

FILE: LRCB11

```
     R        RR
   R

              R
 R
 RR

R
-----------------
```

FILE: LRCB12

```
     RR RCC   RC
        RR R
           RR
             R
R

   RR
  RRRR



      R
        RR
-----------------
```

PHASE ONE - DIFFUSE

FILE: LDD1

```
 RRRRR CRRRRRRR
RR R      RR  RR
CRRRRRRRRRRR RR
   R  RRRRCRRRR
RRRRR RRRR   RR
RRRRRRRRRRRRRRRR
RRRRRRCRRRRRRR
RRRRRR RRRRRRR
RRRRRRRRR RRRRRR
RRRRRRRRRRRC   C
 RRRRRRRRRRRRRRR
 RRRCC   CRRRRRR
RRRRRRRRRRR RRRR
```

FILE: LDD2

```
  RCARR     C   C
R CCCCCCAACRC  C
  R RRRRRCRRCRCA
CCCAR  AAC  ARR
CRCCCCCCCCRRC C
  AAAAAA  CRRCCR
RRRRCRAC    AC
     ACCCRRRRCCR
R    AA  A     A
  CCCCRRCCCRR  A
A  R     R
  CCCCA A     R
 RC          C RC
```

FILE: LDD3

```
A   CRCCCCRCCCR
R RRCRCC C     RR
CC ACCCAAA    RRR
R  R      R CCACC
CCRRACCCAAR
R  CCCCCCRCCCRCR
CC CCCCRCCRRRCCR
R   CRCCRACCCACC
RRCACCCCCCCRRC RC
CRCCCCCCCCR RACR
AACCCRCCRCCCR R
CCRR RRA AA CCCC
RRCCCCR
```

FILE: LDD4

```
      CRRCRRRR
 RRR           A
CC CRCCCC CRRRRR
RR      A ARRCC
     RRRRRRRR
      RRR R   A
RRRRRRRR       R
RRR R  R    RRRRR
R       C    RRRR
  R  CRRRRR
     RRRRRRR
CRRRRR     CRRRR
R RRRR      RRRR
```

FILE: LDD5

```
A  RR        ACRC
RCCRRRC  CAA  A
CCC CC RRRCRCRRR
R   A     RCC CRC
CRC  RRRRRRRCRA
  CCAA RR RRAC C
CCRRCRC        RA
 RR  RR     CC
  A R      R R  C
     CCC R RAAR
   R             RR
      AARC
```

FILE: LDD6

```
CRRRCC RACR   R
   RA ACAACCRRRC
ACCCR   R  RCCCA
AAA ACAR  CCCCRR
R   R R CCACCC A
ACRRCCCC     RRR
R RRRRRRCCCCCCCC
CR C
  CCCRCCR    R
              CRRR
R      R C
 R    RC RCCC
RRRR
```

FILE: LDD7

```
          RRR
RRRRRRRRRR    R
   R  RRRRR   RR
  RR     A
RRR RR  R  RRRA
CR  C      RRRR
 RRRRR R    RR
CA   RRRRRRR
 R       R  A
 RRRRR   RRR
  RAC  AA RR RR
 RR RR         R
 A RRRRRRRC
```

FILE: LDD8

```
RCRR CCR R CC
 RRCAA    RR C
CR R     R  A
    R    CR
  A           R

               C
A R      R
     C CRCC
  R        R
   CCA    CCR
    RR      RAAC
            RRR
```

FILE: LDD9

```
CAA
  CRRCCRRCRAA  C
RACR         CRC
    R   RRRCA
  CCR  C  AAARR
 CRR  C       R
RC R AACCCRR
       RR  RRCCA
AACRRRRRR    R R
RC    RAACCCCRRR
RRC      R R   C
CCCCACRRRRRRRRC
         C AAAAA
```

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OF POOR QUALITY

FILE: LRPD1

```
C  AAA   AACCCCA
        C  CA
 A      CAACA
AAAAAA ACAACCC
AC AACACACCCCA
CCCCCCCC   CCA
CCCCCCCACC ACA
CCCCCCCCCC  CCCA
CCCCCCCCAAAACCC
CCCCCCCCCCCC ACC
CCCCCCCCCCACA CC
CCCCCCCCCCCCAACC
CAACCCCCCCACCC A
```

FILE: LRPD2

```
CC  CCCCCCCCA  C
CCAACCCCCCA
CAAACCAC A
CCCAACACCA
CCCCCCCC    A
CCCCCCCCA   ACC
CCCCCCCCCCC CCCC
CCCCCCCCCCA AACC
CCCCCCCCCCC  CCC
CCCCCCCCCCAAACAC
CCCCCC   A   CAA
ACCCC        CCC
 CAC        CCCC
```

FILE: LRPD3

```
CCCCCCCCCCCCCCCC
ACCCCCCCCCCCCAA
ACCA CACCCCCCACC
CCCC CCCCCCCCCCC
ACCCCCCCCCCCCCCC
CCCCCCA ACCCCCCA
CCCCA    CCACCCC
CACCA  ACCCACCAC
CCCCCC ACCACCC C
CCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCC
ACCCCCCCCACCCCCC
AACCACCCACCCCCCC
```

FILE: LRPD4

```
CCCCAAACCCCAAACC
CCACAAC CCCACCCA
CCCCC CCCACCCCCC
C CCCAAACA ACCCC
CCC CACCAACCCCCC
AACCCCA AACCCAAA
AA       ACCCCA
CAA   A  AAACACC
C  AACCAACC ACCA
A  ACCCCCCC CCA
AAACCCCCCCCCCCAC
AAC ACCCACACCCC
CACCACCCCCCCC CC
```

FILE: LRPD5

```
CCCCAA  ACCCCAA
 C      CCCCCAC
        AACCCACC
         ACCCACC
C          CCACC
A   A        CCC
        AAAA A A
 CCCCAACCACC A
ACCACCC  CCCCCCC
 ACACCCCCCCCA CC
CCCCCCCCCCCA CCC
A CC CCCCCCCCCC
CAACCACCCC  CCCA
```

FILE: LRPD6

```
CCCCCCCCCACCC  A
CCCCCCCCCCC  ACC
CCCCCCCCCCCA  CC
CCCCCCCCCCCA ACC
CCCCCCCCCCCCCACC
CCCCCACCACCCCCCC
CCCCCCAACCCCCAAA
CCCCCCCCACCCAAAC
CCCCCCCA ACCCCCA
CCCCCCA  ACCCACC
CCCAAA A CCCCACC
CCA AAAACCCCCACC
CCACCCCCAA AAACA
```

FILE: LRPD7

```
 CCAACA       CC
ACCCCCCACCCC ACC
CCCCCCCCCCCCCCCC
CCCCCCCACCCCCCCC
CCCCCCC ACCCCCCC
CCCCC   CCCCCCCC
CCCCCA  CCCCCCCC
  CCC   ACCCCCCC
ACAA A  ACCCCCCC
CCA ACC CCACCCCC
CCCCCACC   CCCCC
CCCCCCCC    CCCC
CCCCCCC   ACCCCC
```

FILE: LRPD8

```
CCCCCCCCCCCAAACC
CCCCCCCCCCACCCCC
CCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCA
CCCCCCCCCCCCCCCC
CC CCCCCCCCCCCCC
CCCCCCCCCCCCCCCA
CCCCCCACCCCCCCCC
CCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCC
  ACCCCCCCCCCCCC
```

FILE: LRPD9

```
  ACCCAA CCCCC A
AAACCAAAA   A
CA CCCCCC    A
A  CCCAC  C  A
 CCCCAA ACCCC  A
CCCCCACAAACCCAAA
CACCCCCCCCAAACAC
CCCCCCAAACAAAAAA
CCCCCCCAACC ACCC
CCCCCCCCACAAACCC
CCCCCCCCCCAACCCC
CCCCCCCCCCACCCCC
CACCCCCCAACCCCCC
```

FILE: LRPD10

```
CCCCCCCCCCCCA
CCCCCAACCCCCCC
ACCCCCCCCCCCC A
CCCCCCCCCCCCCCCC
CACCCCCCCCCCCCCC
CCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCC
AACCCCCCCCCCCCAC
CCCCCCCCCCCCACCC
CCCCCCCCCCCA ACA
CCCCCCCCCCCAA AC
CCCCCCCCCCCCC  C
CCCCCCCCCCCCC CC
```

FILE: LRPD12

```
 CCCCCCCCCCCCCCC
CCCCACCC CCCCCCC
CAA CCCCCCCCCCCA
CCCCCCAC  CACCCC
CCCCCCCCCCACCCCC
CAACCCCCCCCCCCCC
CCCCCAACCCCCCCCC
CCCC   CCACCCACC
ACCCCCCCCACC  CA
CCCAAAACAACC CCC
CCCAACCCCCCC  CC
CCACCCCCCAC A CA
AACAACCC     C A
```

FILE: LRPD11

```
CCCCCCCCCCCCCCCC
CCCCCCCCCCCCCACC
CCCCCCCCCCCCCCAC
CCCCCCCCCACCCACC
CCCCCCCCACCCCCCC
CCCCCCCCACCCCACC
CCCCCCCCACCCCAAC
CCCCCACCCCCCCCC
CCCCCCCCCCCCCCAA
CCACCCCCCCCCCCAC
CCCCCCCCCCCCCAA
CCCCCCCCCCCCCCCC
CCCCCCCCCCACCCCC
```

FILE: LRCD1

```
CCCCCCCACCCCCCCC
CCCCCCCCCCC CCCC
CCCCCCCCCCCCACCC
CCACCCCCCCCCCCCC
CC ACCACCCCCAAAC
    CCCCCCCACACC
   CACCCCCCC CCC
CCCCCCCCCCCCCCCC
CCCACCCCCCCCCAAC
AACACCCCCCCCC  C
CCCCCCCCCCCC  AC
CCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCC
```

FILE: LRCD2

```
CCCCCCCACC CCCCC
CACCCACCCCCCCCCC
CCCCC ACCCCAAACC
ACCC  CCCCCAACCC
 CACCCCCCAACCCCA
AAAACCC CCACCAAA
CAAACC  AAACAACC
CCCCCACACACCCCCC
CCCC ACCCCCCCACC
CCCCCCCAACCCCCCA
CCCACCCCACCAAAA
ACCCCCCCCCCACCA
CCCACCCCCCCACCCA
```

FILE: LRCD3

```
CCCCCCCCCACACCCC
CCCCCCCCACCCCCCC
CCCCCCCCCCCCCAAC
CCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCA
CCCCCCCCCCCCCCCA
CCCCCCCCCACCCCCA
CCCCCCCCAACCACCA
CCCCCC CCCCCCCC
CCACA   CCCCCCCC
CCCCCA  AACCCA C
CCCCA   A ACCCAC
CCAAA  A  A  CCC
```

FILE: LRCD4

```
CACCCCCAA AC  AC
CCAACCA  AA ACCC
CCAACCAA  AAACCA
CCCACCC AA AAA A
 ACCCCA  AAAAAAA
CCCCCAAAA CA  CA
CCCACCCCAAAAACCC
CCCCCACCACCCCCCC
CCCCCCCACCCCCCCC
CACACCA AAA CCCC
C CCCA  ACCAACCC
CCCCCCC CCCCACCA
CCCC CCAAAAA CCC
```

FILE: LRCD5

```
CC CCCCCCCCACCCC
CCC CCCCCCA CCCC
CCA CCACCCCA CCC
CCCCAACCCCCCCCCC
CACCCACACAAACCCC
CCCCCCCCCCAACCCC
AAA  CCCCAACCCCC
CA A   CCCCCCAAA
  CCAAAACCCCAACC
 CCCCCACCCCCCCCC
CCCCCCCCCA ACCCC
CCCCCCC  A AAACC
CCCCCC  AAAAAAAC
```

FILE: LRCD6

```
CCCCCAAAA ACCAAC
CCCCCC AAAACCAAA
ACCCCCCCC AAAAAA
CCCCCCCACACCC
CCCCCCC  AACCACA
CCCCCCCCCCC  CCC
CCCCCCCAACCCAACC
CCCCCCCAA C CCCA
CCCCCCCA CCCCCCC
 CCCCACCCCACCCCA
A CCCACCCCA  CCC
ACCCAAACCCAACCCC
AA AAACCACACCCCC
```

FILE: LRCD7

```
CA    AAAAAAA CA
CAAAAAA AAAAACCA
  CC CACCAAAACAC
CCACCCCACCCCA  A
CC CCCCCCCCA ACC
CCCCACAC CCCACCA
CCCCCCCC AAC AAC
CCCCCCCCACCCCCAC
CCCCCCCCCCCCAAAC
CCACCCCACCCCCCCC
CCAACCACCCCCCCCC
C ACCCCCCCCCACCC
 CACCCCCCCCCCCCC
```

FILE: LRCD8

```
A  CACCCCCCCCCCC
 CCCCCCCCACCCCCC
CACCCCCCCCCCCCCC
CACCCCCCCCCCCCCC
CCCCCCCCCCCCCCCC
CCCCCCCCCCCCACCA
CCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCA
 AACCCCC CCCCCCA
 CACACCCCCCCCCCC
CAAACCCCCCCCCCCC
CCCCCCCCCCAAACAA
CCCACCCCCA CAAAA
```

FILE: LRCD9

```
 AA  A AACCAAACC
 A   AAACCCAA A
AAAACAACCCA CAAA
  CA AAACCCC  C
ACCCCCCC  CC  AA
CCCCCCAC CCC   C
CCCCACCA  CC   A
CCC CCAACACC   A
AAAACCCCCC CC  A
 CC C ACCACC CCC
CCCCAACC ACCCCCC
ACCCCCCACCCCCCCC
ACCACCACCCCCCCCC
```

FILE: LRCD10

```
AAAACAAA AAAA
 AA A    AAAAAAA
  A       AAA AA
ACAA A ACC   A
CC   A C A    AA
     AA  A A AAA
A A   AA A  CA A
    AA
C         AA
 A A      C
   AAA AA
     AA  A   A
   AAAA
```

FILE: LRCD11

```
 A C CCCCA CCACC
ACCCCCAC  CACACC
A AC    CCACAAC
  AC    AAAAACCC
CCC     CAACCAAA
CCC  ACC CC AAAA
C CC AAAAAACC CC
C CCAAA    CA AC
   AAAA CC CC
 AACAA      CCAC
    AAA  C
C AA      AA A
AAAA   A  CC CCC
```

FILE: LRCD12

```
A   ACCCCCCCAACC
AA AACCCCC CAAC
A  A AAACAACC  C
AAAAAAAA AAACCCC
CCAAAAACCCA  AAC
CAAACCCA AA  CCA
 CACCACA A   A
ACCCCCCC A   AA
 AACCCCA    CCCA
CACACCCCCC  CACC
 A A CAAACCCAACA
  A  ACCCCA ACA
   AACAACCACACCC
```

PHASE TWO - BLOCKED

FILE: HRB1

```
  1981I1986I1991I1996I2001I2006I
      I    I    I    I    I    I
2276 I R                 R      I 2276
2277 I R                        I 2277
2278 I  RR           RR         I 2278
2279 I R              R         I 2279
2280 I R C                      I 2280
2281 I   RCR             AA     I 2281
2282 IR  RR R      R   R AAA  ARI 2282
2283 I   R        RR          R I 2283
2284 I                          I 2284
2285 I    RR                    I 2285
2286 I        R                 I 2286
2287 I                          I 2287
2288 I    R                     I 2288
2289 I RR     R                 I 2289
2290 I  R                       I 2290
2291 I                      R   I 2291
2292 I                   R      I 2292
2293 I      R R R        R      I 2293
2294 I      RR           R      I 2294
2295 I      R                   I 2295
2296 I        RR             R  I 2296
      I    I    I    I    I    I
  1981I1986I1991I1996I2001I2006I
```

21

FILE: HRB2

```
  2034I2039I2044I2049I2054I2059I
      I    I    I    I    I    I
2276 I         AA R RAAAA       I 2276
2277 I      RR AACRRCAAAAA      I 2277
2278 IR          C  ACAAA  R RRAI 2278
2279 I          CCR CCAARCACR RRI 2279
2280 I           CAARCCAACAACR  I 2280
2281 I   R  R      ACCAAACCAA   I 2281
2282 I                AA A  AA  I 2282
2283 I                      AAA I 2283
2284 IA                   AAAAAAI 2284
2285 I A                 AACAAAAI 2285
2286 IAA  A AA    A      AA AAA I 2286
2287 I       A     AA        AA I 2287
2288 I     AAAA A  A         AA I 2288
2289 I     AAA  AAA  A A     AAAI 2289
2290 IAA        AAA AAAA       AI 2290
2291 IAAAACAAA   A     AA       I 2291
2292 IAAAAAAAC AAA A A AAAA C   I 2292
2293 I AAAAAACCCAAAAAAAAACCACC  I 2293
2294 I AAAAACA  CCAAACRRCACAAA  I 2294
2295 IAACCAACAAAAAACAAAAAAAAA   I 2295
2296 IAACAAAAAA   AAAAAAAAA A   I 2296
      I    I    I    I    I    I
  2034I2039I2044I2049I2054I2059I
```

21

FILE: [illegible]

```
  2086I2091I2096I2101I2106I2111I
      I    I    I    I    I    I
2276 I        RR AA AAA      A  I 2276
2277 I             C A      CAAAI 2277
2278 I        R    C  A      A AI 2278
2279 I RR           R      A  AAI 2279
2280 I         RR  RR     AA   AI 2280
2281 I          R  RRR R   A    I 2281
2282 I         RR    RACR AA    I 2282
2283 I    R     AR RRCRCA AA    I 2283
2284 I    R    ARCR    RR       I 2284
2285 I      R   R          AA   I 2285
2286 I AC         RR    RCA     I 2286
2287 I  CRRR AA RRR  RRCCCC     I 2287
2288 I ACAA   A R A  RRRCCC     I 2288
2289 I  A     A  A R CCCAAA     I 2289
2290 I ACR         A C   AA   AAI 2290
2291 I  RR           AAA  A  AARI 2291
2292 I  RR  R      AAAA R A   CAI 2292
2293 ICCR   R  CA  ACCC     R  AI 2293
2294 IRC    A RCAA  AC       RCCI 2294
2295 IA AA    C A   A          CI 2295
2296 I    R   A          A      I 2296
      I    I    I    I    I    I
  2086I2091I2096I2101I2106I2111I
```

21

FILE: HRB4

```
  1981I1986I1991I1996I2001I2006I
      I    I    I    I    I    I
2318 I                R         I 2318
2319 I R         R    R         I 2319
2320 I   RRR     R              I 2320
2321 I R                        I 2321
2322 I  R    R RRR              I 2322
2323 I    R            R        I 2323
2324 I  R RR      A  RR    A    I 2324
2325 I  R  R     CR             I 2325
2326 I RR  R                    I 2326
2327 I     R                    I 2327
2328 I                          I 2328
2329 I                          I 2329
2330 I               R  R       I 2330
2331 I     R       R R  R       I 2331
2332 I  R  R     R              I 2332
2333 IR    RR              A  AAI 2333
2334 IRR  RR   R            ACR I 2334
2335 IRRRR  RA A  R       R     I 2335
2336 ICR     R CR              RI 2336
2337 ICR  RR RR R      R  AACAAAI 2337
2338 I       R R        R  R    I 2338
      I    I    I    I    I    I
  1981I1986I1991I1996I2001I2006I
```

21

FILE: HRB9

ORIGINAL PAGE IS
OF POOR QUALITY

```
  2086I2091I2096I2101I2106I2111I
      I    I    I    I    I    I
2360 I                      AAA I 2360
2361 IA                      AA I 2361
2362 I        AAAA  AAAA      A I 2362
2363 I  AA     AAA A   A  A     I 2363
2364 I AAAA  AAA  A RRAAAAAAA   I 2364
2365 I   A AAAA   ARCCAAAAA     I 2365
2366 IA  AAA   A  AA  ACCCCA    I 2366
2367 I    AAA AA CRRRC CACA     I 2367
2368 I   A ACRRC   RRC   CA     I 2368
2369 IA A AA RR RRR   RR R      I 2369
2370 IA ARRR RR      R RRR      I 2370
2371 I ACR RRRR  RRR RRRRR R AA I 2371
2372 I AARR RR   ARR  RR RRRR   I 2372
2373 IA RCRRR  RRAAR  RR RRRRRR I 2373
2374 IR  RR   RR RAA  R      RRRI 2374
2375 IAR  R RRR RRRA  AR RRRRRR I 2375
2376 IAA  ACR    RA  CR  AR    RI 2376
2377 IA   RRR R    CAR  AR  RR  I 2377
2378 I      RR R  R C R     CRRRI 2378
2379 IAA     AAR  RARC     RARA I 2379
2380 IA           RRA     C A   I 2380
2381 IA          R  R     A    AI 2381
2382 I         RR RR      A    AI 2382
      I    I    I    I    I    I
  2086I2091I2096I2101I2106I2111I
```

FILE: HRI5


```
  2034I2039I2044I2049I2054I2059I
      I    I    I    I    I    I
2318 I             ACR          I 2318
2319 I    RRRRRRRR RCAA         I 2319
2320 I RRRR  R     RR AA   ACAA I 2320
2321 I    RRR     RRCAA A  A    I 2321
2322 I R    R      A RR        AI 2322
2323 I            RR     A      I 2323
2324 IRRRR   R       RR  AAACA  I 2324
2325 I    R   R     R R  RRR  A I 2325
2326 I RRR    R    R    RRRR  A I 2326
2327 I       R   RR  R    R  AAAI 2327
2328 I  R  RRRRR R R   R    A AAI 2328
2329 IRR RRRRRR          R  RC  I 2329
2330 I R                R       I 2330
2331 I RRR RRR RR       R      RI 2331
2332 I  RR RR  R   R    R      AI 2332
2333 I   RRR  AR   R            I 2333
2334 I R           R     R      I 2334
2335 I                 RR       I 2335
2336 IAAR     R                 I 2336
2337 IAA      R          R      I 2337
2338 I A    R R   R    RR       I 2338
      I    I    I    I    I    I
  2034I2039I2044I2049I2054I2059I
```


FILE: HRB6

```
  2086I2091I2096I2101I2106I2111I
      I    I    I    I    I    I
2318 I            AA            I 2318
2319 I A  ACA AARCAA            I 2319
2320 I      AAA  R          AA  I 2320
2321 I    R  CR R  RRR   RR ARR I 2321
2322 I R  R   RR R         R ARRI 2322
2323 I  R  RRRRRRRR       R AAAAI 2323
2324 I    RR R      R R    RRA  I 2324
2325 IR      RRR     R  RR   RR I 2325
2326 IR   R     RR   R R    RR  I 2326
2327 IR    RR         RR        I 2327
2328 I         RR     R         I 2328
2329 I  R        R   R         RI 2329
2330 I           RR             I 2330
2331 I         R   R            I 2331
2332 I          RRRR            I 2332
2333 I      R RR                I 2333
2334 I R    RR         R   R    I 2334
2335 I R            R           I 2335
2336 I                 R  R    RI 2336
2337 I                RR  R A   I 2337
2338 I      R                   I 2338
      I    I    I    I    I    I
  2086I2091I2096I2101I2106I2111I
```


FILE: HRI7

```
  1981I1986I1991I1996I2001I2006I
      I    I    I    I    I    I
2360 I                    AAAAA I 2360
2361 I A   A AA   AAA   AAAAA A I 2361
2362 IAAAAAAAAAAAAAAAA AAAAAA  AI 2362
2363 I AAAAAAAAA A  AAA A AAAAAAI 2363
2364 IAAAAA  AAAAAAAAAAAAAAAAA AI 2364
2365 IA AAA  AAAAAAAAAAAAAAAA AAI 2365
2366 IAAAAAA AAAAAAAAAAAAAAAAAAAI 2366
2367 IA AAAAAAAAAAAAAAAACAAAAAAAI 2367
2368 IAAA AAAA    A  AAAAAAA   AI 2368
2369 IAAAA A            A A    CI 2369
2370 I     AA  AA AA AA  R      I 2370
2371 I         AA    AA AA A   AI 2371
2372 I         AAAA  AAAACAAAAAAI 2372
2373 IAAA  CAAAAAACCA ACCAAAAAAAI 2373
2374 I   AAA CAAAAA         AA  I 2374
2375 IR AAAAAAA              AAAI 2375
2376 IACAACAA           AAA   A I 2376
2377 I CCA A      AA  AAAA      I 2377
2378 I A  A         AAAAAAAAA   I 2378
2379 I AAAAA    A     A  AAAAAAAI 2379
2380 I AC A     AA  AAA   AAAAAAI 2380
2381 IAA         AAA  AA AACAAAAI 2381
2382 IAACAA A    AAAAAAA AAA  AAI 2382
      I    I    I    I    I    I
  1981I1986I1991I1996I2001I2006I
```


FILE: HRB8

```
  2034I2039I2044I2049I2054I2059I
      I    I    I    I    I    I
2360 I            RR           AI 2360
2361 I     A     AARAAA      AAAI 2361
2362 IAA   A       AAA A AAAAAAAI 2362
2363 IAA A AA      ACRAA A AAAAAI 2363
2364 IAAA AAA          A    ACAAI 2364
2365 ICCCAA AA      A AA      CAI 2365
2366 IAARAAC          A        AI 2366
2367 IRCRAA    R    AAA  AA     I 2367
2368 ICAAACRACA   A AAA AAAAA   I 2368
2369 I AAARACA A   AA   AA AA   I 2369
2370 IACCCAC    AAAA   AA  C A  I 2370
2371 I  C  C     AAAAAAAA  CA   I 2371
2372 I       A  AAAAAA AA  CA   I 2372
2373 IC  A A AAAAAAAAAAAAA A  A I 2373
2374 I CA AAAA AAAAAAAAAA    AAAI 2374
2375 I CA AAAAAA   AAA      AAAAI 2375
2376 I  A   AAA    AAA AA    AAAI 2376
2377 IA AAC AAA     A AAA   AAAAI 2377
2378 IAAAACCCCCCC  AAAAAA  AA ACI 2378
2379 ICACR RACCRRCCCAAAAA AAA AAI 2379
2380 ICAAC CCCCCRRCAAAAA   AA AAI 2380
2381 IAAAARCCCCCCRCCAAA   AAA  AI 2381
2382 IAA ACCACCCCCRAAA   A AAAAAI 2382
      I    I    I    I    I    I
  2034I2039I2044I2049I2054I2059I
```

FILE: SB1

```
    2162I2167I2172I2177I2182I2187I
        I    I    I    I    I    I
1937 I     AAAAAA  A             I 1937
1938 I          AAAA             I 1938
1939 I          AAAA             I 1939
1940 I    R A   AA               I 1940
1941 I       AAAAA AA            I 1941
1942 I   AAA CRAC   A            I 1942
1943 IAAAACCAAC  A    A          I 1943
1944 IAAAAAAAACA A AA A          I 1944
1945 IA AAAAAACAA AAAAAA A       I 1945
1946 IAAAA  C ACCA AA  A         I 1946
1947 IAAAA CAAAA A   AAA         I 1947
1948 IAACRRRCCRACC    AAA        I 1948
1949 I CACCRRRRR  A  RCAA        I 1949
1950 IACCA C   CCRAAR RAA        I 1950
1951 IACCC     RACCACAAAA        I 1951
1952 I  AAC  AC ACAACAAA         I 1952
1953 IRRAAAR    AA  AA         A I 1953
1954 IAAACCCR     AAAAAA  A    A I 1954
1955 I  AAACCCCRCCCCAAA AAAA   AAI 1955
1956 I  AAAAACCCCRAACA     AAAAAAI 1956
1957 I AACCAR RRARRRCA A       AAI 1957
        I    I    I    I    I    I
    2162I2167I2172I2177I2182I2187I
```

21

FILE: SB2

```
    2214I2219I2224I2229I2234I2239I
        I    I    I    I    I    I
1937 I A  AAACA.         A AA I 1937
1938 I AA CCCCA       AAAA  ACI 1938
1939 I    AAACA               CI 1939
1940 IA       A  A    AA AA   AI 1940
1941 IAC      A  AAAA  A A AAAACRI 1941
1942 IC      AAAAA  A     AAAA AA I 1942
1943 ICR  RRAAAAAAA     AA AAAAARI 1943
1944 ICC  RCCA A   A         A  AI 1944
1945 IR     CAAAA          AAAAAAAI 1945
1946 I       CCAAA         AA   AAI 1946
1947 IC      AACAA A            AAI 1947
1948 IA         CC A            ARI 1948
1949 I            CAAAA         A I 1949
1950 I            CAAAAA        ARI 1950
1951 I            CCAA           AI 1951
1952 IRCR   R     CAA            AI 1952
1953 ICAR C  CAACA               AI 1953
1954 ICAA ACCCAAAA              A I 1954
1955 ICCR  A AAAAAA         AAA I 1955
1956 IARA  R AAAAAA              I 1956
1957 IACA RAA CAAA              CI 1957
        I    I    I    I    I    I
    2214I2219I2224I2229I2234I2239I
```

21

FILE: SB3

```
    2162I2167I2172I2177I2182I2187I
        I    I    I    I    I    I
1978 I               AA    AR  ARI 1978
1979 I            AAAA     A  A AAI 1979
1980 I             AA   AAAA AA AI 1980
1981 I A        AAA      AA      I 1981
1982 I       A  RCCA             I 1982
1983 IAA         A               I 1983
1984 IAAA       A                I 1984
1985 I CRR    AA                 I 1985
1986 I AC    AAA                 I 1986
1987 I  A    AA      RRR         I 1987
1988 I    A            A         I 1988
1989 I                           I 1989
1990 IC                          I 1990
1991 I                   RR      I 1991
1992 I                  R        I 1992
1993 I                           I 1993
1994 I                           I 1994
1995 I                           I 1995
1996 I                           I 1996
1997 I                          AI 1997
1998 I                           I 1998
        I    I    I    I    I    I
    2162I2167I2172I2177I2182I2187I
```

21

FILE: SB4

```
    2214I2219I2224I2229I2234I2239I
        I    I    I    I    I    I
1978 I                     AAAAA I 1978
1979 IA                      AA  AI 1979
1980 I                       A   AI 1980
1981 I                           AI 1981
1982 I                           RI 1982
1983 I                AA          I 1983
1984 I                            I 1984
1985 I                           CI 1985
1986 I                            I 1986
1987 I                           AI 1987
1988 I                           CI 1988
1989 I                           CI 1989
1990 I                            I 1990
1991 I                            I 1991
1992 I                            I 1992
1993 I                            I 1993
1994 I                            I 1994
1995 I                            I 1995
1996 I AA                         I 1996
1997 I  AAA                       I 1997
1998 I         AA A               I 1998
        I    I    I    I    I    I
    2214I2219I2224I2229I2234I2239I
```

21

FILE: SB5

```
  2162I2167I2172I2177I2182I2187I
      I    I    I    I    I    I
2020 I            R             I 2020
2021 I      R     R R           I 2021
2022 I    R    RR RRR           I 2022
2023 I          RRRR  R         I 2023
2024 I             R       R    I 2024
2025 I        RR RRR         RRRI 2025
2026 I   R       R RR       R   I 2026
2027 I    A    R RRR            I 2027
2028 ICA        R R   RR    RRR I 2028
2029 I AAC     R     RRR      RRI 2029
2030 IAAC             R   RRR   I 2030
2031 I  A                  RRR RI 2031
2032 IAC              RR     RRRI 2032
2033 I                R R       I 2033
2034 I       R       R        R I 2034
2035 I C   RRRR      R    R     I 2035
2036 IAC  RRR R  R      RRA  R  I 2036
2037 I RC RRR    R      RRRRC   I 2037
2038 IR          R       CRR    I 2038
2039 I         R        R  RR   I 2039
2040 I        R          R      I 2040
      I    I    I    I    I    I
  2162I2167I2172I2177I2182I2187I
```

21

FILE: SB6

```
  2214I2219I2224I2229I2234I2239I
      I    I    I    I    I    I
2020 ICCRCARCACAAACACRR    CA   I 2020
2021 ICRCCACRRCAAACRC   RR  A   I 2021
2022 IARCRRC  RCCCCCCR        RRI 2022
2023 IRRCCRR  RCRRRR  R  R   R  I 2023
2024 IR  RR   RRR  RR    R      I 2024
2025 I R       RR RR            I 2025
2026 I         RR CR            I 2026
2027 IC            AR           I 2027
2028 ICC       RR RCCC         RI 2028
2029 IACCR        RCAA          I 2029
2030 IAR AR          RC         I 2030
2031 I AAAACAA        CCRRR R  RI 2031
2032 IA  AAAACA R    RCRRRR     I 2032
2033 IAC AACCCCAAAAAARC CCCRR   I 2033
2034 I CCCCACCC   RCAAAAAAACRRR I 2034
2035 I CC     AARRAACC CACCR    I 2035
2036 I CC CR    RAAACCRCCRCRRCCCI 2036
2037 I CR    RCCRACACCCA  RC RCCI 2037
2038 I CC A CR   R CRR     ACR CI 2038
2039 IAACC C        R     RCRR CI 2039
2040 IAACCCC  CCCC   AAC   RCCC I 2040
      I    I    I    I    I    I
  2214I2219I2224I2229I2234I2239I
```

21

FILE: SB7

```
  2162I2167I2172I2177I2182I2187I
      I    I    I    I    I    I
2062 I         AAA           AAAI 2062
2063 IA         A           AC  I 2063
2064 I         AA       A    A  I 2064
2065 I               AAA     AA I 2065
2066 I         A AA        AAAAAI 2066
2067 I          A AAA          AI 2067
2068 I          AAA         AAA I 2068
2069 I        AAAA A AA     A   I 2069
2070 I       AAA AAA AA      A  I 2070
2071 I  AC   ARRR  RRRR     C AAI 2071
2072 I CRR   RRRRRRR R RRRRCR   I 2072
2073 IAC R    RRRR   R RRRRRR CRI 2073
2074 I AC R RRRRR     R   R RR RI 2074
2075 I  R R R R       R R  R   RI 2075
2076 I ARRRRRRR       RRRRRR  RRI 2076
2077 I  R  RR RRR       RR  RRRRI 2077
2078 I  RRRRR  RR  R  RRRR  RR  I 2078
2079 I RRC RRRRR   RRR   RRRRR RI 2079
2080 I  C   C RRRRR RRRR R RR   I 2080
2081 I   AAAACC R RRRA   R      I 2081
2082 I   R C ACC            RRR I 2082
      I    I    I    I    I    I
  2162I2167I2172I2177I2182I2187I
```

21

FILE: SB8

```
  2214I2219I2224I2229I2234I2239I
      I    I    I    I    I    I
2062 I  ACRRCRCCCCCCCCCRCCRRRCCCI 2062
2063 IA  AAAAAAR RRAAAAACCA  CRCI 2063
2064 I    AAC   RCCAAAA AAARCACCI 2064
2065 IA   CRCRR RCCA A   AA   ACI 2065
2066 IA       R R              AI 2066
2067 I  RC    RCRCCCAAA         I 2067
2068 I    R ARR  CACA CA        I 2068
2069 I  AARRRR  R  A  R         I 2069
2070 IA R R  RR RR A  RC        I 2070
2071 IAAR  CAACC R C  R A       I 2071
2072 IAA RCRCC CCCAC   A        I 2072
2073 IA CC AAACAARRRA AA        I 2073
2074 IA     AACCACCCCARC        I 2074
2075 I   R  CCACCC RR A         I 2075
2076 I   AA  CCRCCC             I 2076
2077 IA      CCCCCC  A          I 2077
2078 IAAA           A           I 2078
2079 IAACR  C   A               I 2079
2080 IAACR     AAA             AI 2080
2081 IA  CA    ARAA          A  I 2081
2082 I                   A  R A I 2082
      I    I    I    I    I    I
  2214I2219I2224I2229I2234I2239I
```

21

FILE: CCB1

```
  2017I2022I2027I2032I2037I2042I
      I    I    I    I    I    I
1791 IAA         C RR A AAAA    I 1791
1792 I          AC   CA  AAAA   I 1792
1793 I          AC     A A      I 1793
1794 I  AAACCR  AAA   AA        I 1794
1795 I C CCC CRR        A       I 1795
1796 I C AACC RAA     AC     RRRI 1796
1797 I   RAACCACA     A         I 1797
1798 I  C   A AA      C         I 1798
1799 I   CR  A        A         I 1799
1800 I   AR RA     AA A         I 1800
1801 I   R  A       A AC  RCC C I 1801
1802 I   C  AAA      AACRRRARR  I 1802
1803 I   C   A        AC    RRCRI 1803
1804 I   A   AA A   AAC     R   I 1804
1805 I  A  AAAAAAA   AAAA   C   I 1805
1806 I AA A A AAAA           R  I 1806
1807 I A        A            A  I 1807
1808 I A   AA AAA            A  I 1808
1809 I  AAA  A AA               I 1809
1810 I   AA    AA            CA I 1810
1811 I  A        A              I 1811
      I    I    I    I    I    I
  2017I2022I2027I2032I2037I2042I
```

21

FILE: CCB2

```
  2069I2074I2079I2084I2089I
      I    I    I    I    I
1791 I  R       R ACA    AA AAAI 1791
1792 I  RR      RC        A    I 1792
1793 IAAC      ACCAAA A  A   AAI 1793
1794 IAAR       AAAAAAAAAAAAACRI 1794
1795 ICRCCA   AACCCAAAA    AA  I 1795
1796 ICCCAAA  ACACAAAA       AAI 1796
1797 I    CAA RRRRC AA    AA  AI 1797
1798 I   ACAACR RR           AAI 1798
1799 IRCCC AAA  R            AAI 1799
1800 I RRR  AACCR    A       AAI 1800
1801 IRR RRRRAAA R           AAI 1801
1802 IC RR    AARR  RA       AAI 1802
1803 IR RRRR   CCCCRCA  A      I 1803
1804 I   RRR   CCCCR AAAAA   AAI 1804
1805 I   R     AAAAAAAC C      I 1805
1806 I    C     AA     RA      I 1806
1807 I    A      AA   A AA     I 1807
1808 I    C AA  AA  AA       A  I 1808
1809 I    C R A  A  AAAA A   AAI 1809
1810 I         CAAAAA  A A   AAI 1810
1811 IA         ACA A AR  AA A I 1811
      I    I    I    I    I
  2069I2074I2079I2084I2089I
```

21

FILE: CCB3

```
  2121I2126I2131I2136I2141I2146I
      I    I    I    I    I    I
1791 ICCA     AA         R      I 1791
1792 IC        R         R      I 1792
1793 I             R   RR       I 1793
1794 I    CA       R RR RR      I 1794
1795 I     A         CCCCR      I 1795
1796 IAAACCAA A     RR          I 1796
1797 ICCCCCRAA       RR         I 1797
1798 IA   ACC  A    RRR         I 1798
1799 I AA            A         I 1799
1800 IA  A                   RR I 1800
1801 I   A               C   RR I 1801
1802 IACAAA                  R RI 1802
1803 IAARR                    R I 1803
1804 IAA               AC       I 1804
1805 IA  RCAA    R              I 1805
1806 I   AAAA                   I 1806
1807 I   A         RAA          I 1807
1808 IC                         I 1808
1809 I                  C    A  I 1809
1810 I A A           AA A   AA  I 1810
1811 ICAAAA      C        A     I 1811
      I    I    I    I    I    I
  2121I2126I2131I2136I2141I2146I
```

21

FILE: CCB4

```
  2017I2022I2027I2032I2037I2042I
      I    I    I    I    I    I
1833 IRRR              RCAR     I 1833
1834 I R         R      CCR    RI 1834
1835 I AARRR    R      RRR    RRI 1835
1836 I  R      RRRR    RCR      I 1836
1837 I             RRRRR R R    I 1837
1838 I    RR   R RR           A I 1838
1839 I         RAC AA         A I 1839
1840 I     RR    CR             I 1840
1841 I     RRR      R         AAI 1841
1842 I              R         C I 1842
1843 I    A          A        R I 1843
1844 I A  CCR         RR        I 1844
1845 I   R    CR A       R      I 1845
1846 I        C       A  CR     I 1846
1847 I      CC   A            R I 1847
1848 I       CC                 I 1848
1849 IR                         I 1849
1850 IRRR    A                  I 1850
1851 IR     A    R              I 1851
1852 IR          RA  A          I 1852
1853 I    R      RAA  A         I 1853
      I    I    I    I    I    I
  2017I2022I2027I2032I2037I2042I
```

21

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FILE: CCB5

```
   2069I2074I2079I2084I2089I
       I    I    I    I    I
1833 I    A    CRAACAAA  AAAAA I 1833
1834 I   A     ARACCAAAA AAAAA I 1834
1835 I  RRR      CCCCAA AAAAAI 1835
1836 I  R  R      A AAAAC   AI 1836
1837 IAA ACR A  AA  AAA     AI 1837
1838 I      AAAAA   AA       I 1838
1839 I     CCCACCAAAAA      CI 1839
1840 IAA  CCCAHAC   AAA    A CI 1840
1841 I  R CCAAACAA  AAA    A  I 1841
1842 I  C CACACCA          A   I 1842
1843 I ACA     AAAA        C   I 1843
1844 I    C    ACCA    A   C   I 1844
1845 I         C AR   A    AA  I 1845
1846 I     C AAAAC  AAC     ACRI 1846
1847 I      CACAACR      AA    I 1847
1848 I      C            A     I 1848
1849 I                         I 1849
1850 I             C           I 1850
1851 I                      R  I 1851
1852 I                R     R  I 1852
1853 I        R      R  R R    I 1853
       I    I    I    I    I
   2069I2074I2079I2084I2089I
```

21

FILE: CCB6

```
   2121I2126I2131I2136I2141I2146I
       I    I    I    I    I    I
1833 IAAAA R                CA      I 1833
1834 IAAAAAA                        I 1834
1835 IAAAAAA              A         I 1835
1836 IRCAA A    A         A         I 1836
1837 IRR               AAA AA A  R  I 1837
1838 IAA               AAAAAAA      I 1838
1839 IA       R  RA   AAAA AAA      I 1839
1840 IA                RCC       R  I 1840
1841 I            CA A AAA          I 1841
1842 I          A C      A          I 1842
1843 I         A AR                AI 1843
1844 I         RR    R              I 1844
1845 I                              I 1845
1846 IA R       RRR           A     I 1846
1847 I      AA      R    R          I 1847
1848 IR AA AA              R        I 1848
1849 I  A    RR          A       RRI 1849
1850 I                            RRI 1850
1851 I                              I 1851
1852 I                              I 1852
1853 I        RC         A  A    R  I 1853
       I    I    I    I    I    I
   2121I2126I2131I2136I2141I2146I
```

21

FILE: CCB7

```
   2017I2022I2027I2032I2037I2042I
       I    I    I    I    I    I
1875 I                RRR R  A ARRI 1875
1876 I                 RRR   CRCRCI 1876
1877 I                  RRR AARR CI 1877
1878 I               RR  CCAARRCAAI 1878
1879 I    A   AAAA CR AACRAAAAAAAI 1879
1880 ICRRRC  C  CAAA    RCCCACAAI 1880
1881 I CCCCRAAAAACAAAA  RRAAACAAI 1881
1882 IRRCRRA    AAACAA RR  ACCCCI 1882
1883 IRCRRRA    A  A    R    CCCI 1883
1884 I CCCRCA      AAA      ACRCI 1884
1885 IARCRRRRCA     AA   RR  CCI 1885
1886 ICCRRRRRRA    CA A    RRR AI 1886
1887 I  AACR AC    AACAAC  R   AI 1887
1888 I                  CA A     I 1888
1889 I   R             AAA       I 1889
1890 I                   A       I 1890
1891 I            A              I 1891
1892 I           R               I 1892
1893 I              A  R         I 1893
1894 I             R R           I 1894
1895 I             RRR    RCCR CCI 1895
       I    I    I    I    I    I
   2017I2022I2027I2032I2037I2042I
```

21

FILE: CCB8

```
   2069I2074I2079I2084I2089I
       I    I    I    I    I
1875 IRRCCCR    RR                I 1875
1876 IRCCCC   RR                  I 1876
1877 ICR RR RR                    I 1877
1878 I    R R  R                  I 1878
1879 I       RR                   I 1879
1880 I            A               I 1880
1881 I       R            R R     I 1881
1882 I                            I 1882
1883 I         A    R     RR      I 1883
1884 I         A    AARRCCRR      I 1884
1885 I    AARR       ACRC         I 1885
1886 IR  RR     A   AAACCA        I 1886
1887 IR             ACCRCAA       I 1887
1888 IR    R     A     CC AA      I 1888
1889 I   R       A                I 1889
1890 I                            I 1890
1891 I    A                       I 1891
1892 I     AA              AA     I 1892
1893 I                      AC    I 1893
1894 I R                    RA AI 1894
1895 I    RA      AA        A     I 1895
       I    I    I    I    I
   2069I2074I2079I2084I2089I
```

21

FILE: CC69


```
  2121I2126I2131I2136I2141I2146I
      I    I    I    I    I    I
1875 I                    R   RCI 1875
1876 I   A                  R R I 1876
1877 I  A               R R RR RI 1877
1878 I   R                RRRRR I 1878
1879 I   R                 RRR  I 1879
1880 I       R              CA  I 1880
1881 I R      CR       R      A I 1881
1882 IRC      RRR      R  R A   I 1882
1883 ICCCCCRCCRCC      R  A AA  I 1883
1884 I CCCCCCCCC        ACAAAA  I 1884
1885 I      RC      R  AA A  A  I 1885
1886 I      R      R   C    A   I 1886
1887 I             AAAAA   CC   I 1887
1888 I           A AAAAA   CAA AI 1888
1889 I    A      AA  AAAAC    A I 1889
1890 I          A     AACC  AA  I 1890
1891 IRRRRR  ACAAA   R R     AAAI 1891
1892 I   R ACCAAAAAR            I 1892
1893 IRCAA R RAAAAA             AI 1893
1894 IAAA    RCAACC    RRRRCAAAAI 1894
1895 ICCA    RRCAAAC       CAAAAI 1895
      I    I    I    I    I    I
  2121I2126I2131I2136I2141I2146I
```

21

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FILE: LB1

```
  1798I1803I1808I1813I1818I1823I
      I    I    I    I    I    I
2276 IAA   AA AA   R            I 2276
2277 I      AA A RR          A  I 2277
2278 I    ACCC AA C         R   I 2278
2279 IAA AACCAAAAA       C      I 2279
2280 I ACA   A  C   C   R       I 2280
2281 IR R  A    C   A A         I 2281
2282 IR   AA  A     A RRC       I 2282
2283 I  AAAAACA           A A   I 2283
2284 IAAAAA AAAAAA              I 2284
2285 IAAAAA   AAAAAA            I 2285
2286 I   AA    AAAAA            I 2286
2287 I   AAACAAAA  AAA          I 2287
2288 I   AAAAAA ACAAAA AA       I 2288
2289 IA  A     AAAAA  AAA       I 2289
2290 IAA AA  A   AC       A  A  I 2290
2291 IAA AAA      AA  A         I 2291
2292 IA  AA A    AAA  CCACR     I 2292
2293 I  AAAAAA    AAAAAAAAR     I 2293
2294 I       AAAA AAAAAAAAAA    I 2294
2295 I        A    AAAAA A A    I 2295
2296 I    R     R   ARCRRARRRR  I 2296
      I    I    I    I    I    I
  1798I1803I1808I1813I1818I1823I
```

21

FILE: LB2

```
  1851I1856I1861I1866I1871I1876I
      I    I    I    I    I    I
2276 I                 AAAAAAAA I 2276
2277 I                          I 2277
2278 I                          I 2278
2279 I      CA                  I 2279
2280 I        R    A            I 2280
2281 I            CRR           I 2281
2282 I   A        C  R          I 2282
2283 IAA   A       C  A         I 2283
2284 I AA        RRCAAAA        I 2284
2285 I AAA A     C CCRA  R      I 2285
2286 IACAAAAAAA RR R RRRA       I 2286
2287 ICCAAA A C  RRR  R  R      I 2287
2288 ICRCCCCAARRRRRR   RCRR     I 2288
2289 I RRRCCRAR     R   RRRRRRR I 2289
2290 I  RRR ACA         CACR RR I 2290
2291 I         R      RCCACCCCRRI 2291
2292 I       RR CC    RCCCCRCR  I 2292
2293 I          RR   RRCCCR RR RI 2293
2294 I           RRR RRRRRRR R RI 2294
2295 I            R    RCCCA  R I 2295
2296 I   RRR                  R I 2296
      I    I    I    I    I    I
  1851I1856I1861I1866I1871I1876I
```

21

FILE: LB3

```
  1903I1908I1913I1918I1923I1928I
      I    I    I    I    I    I
2276 I          A               I 2276
2277 I   RR             A     C I 2277
2278 I  R R  A A       A        I 2278
2279 IRRR  RA                A  I 2279
2280 I R    RCA         R    A  I 2280
2281 I RRR R                    I 2281
2282 IRRRRR  A          A       I 2282
2283 IRR     A          C A     I 2283
2284 IRR R                      I 2284
2285 I   R  AC                  I 2285
2286 I  R  AARA                 I 2286
2287 IRRR RRRR                  I 2287
2288 I R RR                     I 2288
2289 I  R R                     I 2289
2290 IR   RR                    I 2290
2291 IRRRRRR        A           I 2291
2292 I R RR                     I 2292
2293 I  R        RR             I 2293
2294 I                          I 2294
2295 I                          I 2295
2296 I                          I 2296
      I    I    I    I    I    I
  1903I1908I1913I1918I1923I1928I
```

21

FILE: LB4

```
  1798I1803I1808I1813I1818I1823I
      I    I    I    I    I    I
2318 IACAAAC  AC  AAA   ACRACCR I 2318
2319 I  CCA ARAA ACCAAAAR C ARA I 2319
2320 IA ACCCCRR     AA  CAAAA   I 2320
2321 I AAAACCCAACCC RCCA A  AA  I 2321
2322 I  A ACC     C AA   AAA AA I 2322
2323 I            A             I 2323
2324 I                 A  AAC  AI 2324
2325 I A            AAAA AA  C AI 2325
2326 IAC RR   C CCCCA AA A  AAA I 2326
2327 ICCRR  CCCCCCCCCAAAAAAAAAAAI 2327
2328 IRRAACACCAAACCAA AC R RRA AI 2328
2329 IR AAA RCCAACCA  A     R  RI 2329
2330 IC AAACAAAAAAA      RRRR R I 2330
2331 IAAAAAA  A  A  A   A  RRRAAI 2331
2332 IRRAAACAAAC  AA   A        I 2332
2333 I   CCAACC      AAA        I 2333
2334 IA     CCC                 I 2334
2335 IA   AAACCC A              I 2335
2336 I A   A ACCAAA             I 2336
2337 I  AA    AAAAA             I 2337
2338 IAAAA          AAAA       AI 2338
      I    I    I    I    I    I
  1798I1803I1808I1813I1818I1823I
```

21

FILE: LB5

```
  1850I1855I1860I1865I1870I1875I
      I    I    I    I    I    I
2318 I      A    RR R   R     R I 2318
2319 IA     AR  R   R   RR     RI 2319
2320 IA AAAAA   RA RRR   R      I 2320
2321 IAAA RRA     R R           I 2321
2322 IC AACRC         R         I 2322
2323 ICRR  RC                   I 2323
2324 IR                         I 2324
2325 I                          I 2325
2326 I                          I 2326
2327 I                          I 2327
2328 I                          I 2328
2329 IR                         I 2329
2330 IR                         I 2330
2331 I  RRCRR                   I 2331
2332 I   C  R                   I 2332
2333 I   RRC R                  I 2333
2334 I  RR                      I 2334
2335 I                     R    I 2335
2336 I                         RI 2336
2337 I  R C RR R        R       I 2337
2338 I  ARC R     RRRR  RRRRR R I 2338
      I    I    I    I    I    I
  1850I1855I1860I1865I1870I1875I
```

21

FILE: LB6

```
  1903I1908I1913I1918I1923I1928I
      I    I    I    I    I    I
2318 I                     RR R I 2318
2319 I              A      R    I 2319
2320 I                          I 2320
2321 I   R R                    I 2321
2322 I   RR       RA            I 2322
2323 I             AAA          I 2323
2324 I               AA     R   I 2324
2325 I               AA         I 2325
2326 I                A   R     I 2326
2327 I               AA  ARR    I 2327
2328 I   A         AA   A  R   RI 2328
2329 I   A              A RRRR  I 2329
2330 I   AA              A RR   I 2330
2331 I  AAAA            AR RR   I 2331
2332 I   C               A AA   I 2332
2333 I                  AAAAC   I 2333
2334 I     AA             AA    I 2334
2335 I A                        I 2335
2336 IC   A                     I 2336
2337 IR   A            AA       I 2337
2338 I  A               AAA     I 2338
      I    I    I    I    I    I
  1903I1908I1913I1918I1923I1928I
```

21

FILE: LB7

```
  1797I1802I1807I1812I1817I1822I
      I    I    I    I    I    I
2360 IACCRRRRR       A   ACR  ACI 2360
2361 IRC    RCAA     AAA AAAAAACI 2361
2362 I C     CACA  A AAA AAAAAA I 2362
2363 I       RAAAAAA      AAAAA I 2363
2364 I     RR A AAA       A  AAAI 2364
2365 ICRC   RC  A A       AA   AI 2365
2366 I            A           AI 2366
2367 ICR  RR    A               I 2367
2368 IA      AA  AAAAR      AC  I 2368
2369 I A     A   A AC    CC   CAAI 2369
2370 IAAAA   AAA  AA    CAAAA  AI 2370
2371 IAAAAAAAAAA AAA AAAAAAAAA AI 2371
2372 IACAAAACCCAAAAAAAA   AAAAAAI 2372
2373 ICACCA CAAAAAAAAAAAAAACCAAAI 2373
2374 IAAAAAAAAAAAACRAAAAAAAAAAAAI 2374
2375 I AAACR RAACCAAAACAAAAA AAAI 2375
2376 IAAACACCCACCC        AAACAAI 2376
2377 ICAAAR  CRR  R       AAAAAAI 2377
2378 IAACC        R         AAAAI 2378
2379 I  R RR    RRRR            I 2379
2380 I RR  R     R              I 2380
2381 I          A C             I 2381
      I    I    I    I    I    I
  1797I1802I1807I1812I1817I1822I
```

22

FILE: LB8

```
  1849I1854I1859I1864I1869I1874I
      I    I    I    I    I    I
2360 IA  R  A RAAAA AAA   A  ACAI 2360
2361 IA RR   AAACRR    C  A     I 2361
2362 I  AA   AC  A  CA        AAI 2362
2363 IA AA  AA                 AI 2363
2364 I  AAAAAA         A     CRCI 2364
2365 IAAAAAAA           R C C RCI 2365
2366 IAAAAA    AAA   A    AA CAAI 2366
2367 IA AAAA  AAAA   AAAA A  AA I 2367
2368 IAACAA  A     AAA CAAAAA AAI 2368
2369 IAA A            AAAAAAAAAAI 2369
2370 I   A    A             AAAAI 2370
2371 I   AAAAA  AA              I 2371
2372 I    AA   ACR              I 2372
2373 I    AAAA  ACR             I 2373
2374 I   ACAAAAAA               I 2374
2375 I A     A                  I 2375
2376 I                          I 2376
2377 I                          I 2377
2378 I                          I 2378
2379 I                          I 2379
2380 I                          I 2380
      I    I    I    I    I    I
  1849I1854I1859I1864I1869I1874I
```

21

FILE: LB9

```
  1901I1906I1911I1916I1921I1926I
      I    I    I    I    I    I
2360 I  C                       I 2360
2361 I                     C    I 2361
2362 IAAA                 R  RC I 2362
2363 IA  A                 RCRCRI 2363
2364 I   A                 CC RRI 2364
2365 I    A              RAA    I 2365
2366 IA                  RCCR  CI 2366
2367 I              AA   CCCR CCI 2367
2368 I             RAAR AR R CCRI 2368
2369 I   A         CA  AAACR  CRI 2369
2370 I CCA      ACAAAAAAAAAC RA I 2370
2371 I CC  RR  ACCCAAAAAAAACCAACI 2371
2372 IARCRCCCRA    AAAAAAAAACCAAI 2372
2373 IARRCCAARAA A       AAACCCAI 2373
2374 I     AACA  A  A A     CCACI 2374
2375 I AA      AAAAAAAA    AACCCI 2375
2376 I         AAC  AAAAAAAACCCRI 2376
2377 I   A       CRRCAAAA A A AAI 2377
2378 I  A  C        RRRAAAAA   AI 2378
2379 I                R A     A I 2379
2380 I                 R A      I 2380
      I    I    I    I    I    I
  1901I1906I1911I1916I1921I1926I
```

PHASE TWO - DIFFUSE

FILE: HRD1

```
  1981I1986I1991I1996I2001I2006I
      I    I    I    I    I    I
2276 IRRRR   R R RRR    RR   R  I 2276
2277 IRC           R    R    R  I 2277
2278 IRRR      R  R  RR      RRRI 2278
2279 IR         RRR R RR     RR I 2279
2280 IR   R RR  RRR   RCRRR  RRRI 2280
2281 IR   C       R  RR CCCRC   I 2281
2282 I   RR R    RR    RRCCCRCCCI 2282
2283 IR  RRRRR   RRR   R   CRRCRI 2283
2284 IR     RRR RRR   RR    RRR I 2284
2285 IRRRRRRRRRR  R   RRRR  RRRRI 2285
2286 I    RRRRR          RRRR RRI 2286
2287 I      R R        RR R R R I 2287
2288 IRRRRRRRR      R   RR    RRI 2288
2289 IRRR   RRR             R RRI 2289
2290 I CC                   R RRI 2290
2291 I C                    R  RI 2291
2292 IRRR        RRR            I 2292
2293 I   RRRR R RRRRRR         RI 2293
2294 I RRRRRRRRRRRRRRRR  RCR   AI 2294
2295 I  RR  R RRR R R  RRRCR   AI 2295
2296 IRRRRRRRRRRR  RR    R R RC I 2296
      I    I    I    I    I    I
  1981I1986I1991I1996I2001I2006I
```

21

FILE: HRD2

```
  2034I2039I2044I2049I2054I2059I
      I    I    I    I    I    I
2276 IR   RRRRRACRR  R RRC  R  RI 2276
2277 IR   RRRRRCRC     RCAA  C RI 2277
2278 ICR   R RRRC      RCACR RRCI 2278
2279 IR     R  RR     CR RCCR RCI 2279
2280 I CARR    RCR R CC  R  RC  I 2280
2281 I CRR  R   RRCRR  RRR RC RRI 2281
2282 IA  RRR   RRRRCCCCCCCCRCCCRI 2282
2283 I   A  RRRRR RRRCR C AAC RRI 2283
2284 IA     RRRRR RR   R AARR RCI 2284
2285 I CCCC      RRR   R CRRRCCCI 2285
2286 ICCCCCCCCA ARCRRR RCCCCCCRRI 2286
2287 ICCACCCCCAAAACCCCR RRR RACRI 2287
2288 ICAACCCCCCCCCCCCA      ACCRI 2288
2289 IACCACCCCRCCCCCACCCAA  CCCCI 2289
2290 ICCCRCARCRCCCCCCCCAAA    ARI 2290
2291 IRRCCCCCCRCCCCCCCCCCCC  RCRI 2291
2292 IC RC RC RCCCRCCCCCRRCCC   I 2292
2293 ICRRC     RRRRRCCCCCRCCCARRI 2293
2294 ICCCCR      RRRR   RRCCCCR I 2294
2295 ICCRRRR R  CCCRRRRRRRCRRAA I 2295
2296 ICRRCCACCCCA CCCCCCCCACCCA I 2296
      I    I    I    I    I    I
  2034I2039I2044I2049I2054I2059I
```

21

FILE: HRD3

```
  2086I2091I2096I2101I2106I2111I
      I    I    I    I    I    I
2276 I        RRRCR   C  RRRRA AI 2276
2277 I       RR ACC   CR CRRCCCCI 2277
2278 I  AR   RR       RR  RRCCCCI 2278
2279 I RRR         RCCRR  CCCCRCI 2279
2280 I RRRR   RRRRCRRRR R CCRRRCI 2280
2281 IRRRRR RRRRR CRRCRRRRCCR  CI 2281
2282 IA RRR R   R     CCRRCCC  AI 2282
2283 I CR R RR RCR   CC RRCCRR AI 2283
2284 IRRR R  RACCCCR RARRRCACRRRI 2284
2285 I     RRR RCCR R RRCRRCR  RI 2285
2286 I CC  R A RRRCRRRR R CAC RAI 2286
2287 I  RRRRRCARR CRRR    CCR  AI 2287
2288 IC RCRCRRCRRRC  RR RCRCR   I 2288
2289 I A A RR  AA CRCCCCRRC   CCI 2289
2290 I ACR RRRRAA ACC     CR RCCI 2290
2291 I RRR R R RRA ACCC   RCRCCRI 2291
2292 I CRRR R  RCAACRRRCRR CR CRI 2292
2293 ICCRR RR  C   C  R RRRRR RRI 2293
2294 ICCCRRRCRRRRA AR CR RRR RCCI 2294
2295 ICCCCRRRC  RC AC   AC      I 2295
2296 IRRCRRRR R CCCAACARAC      I 2296
      I    I    I    I    I    I
  2086I2091I2096I2101I2106I2111I
```

21

FILE: HRD4

```
  1981I1986I1991I1996I2001I2006I
      I    I    I    I    I    I
2318 IR RRRRRRRRR   RRR       R I 2318
2319 I RRRRRR RRRRRRRRRR        I 2319
2320 IR  RRRRRRRRRRRR RRR       I 2320
2321 I R   R  RRRRRR  RR        I 2321
2322 I RRRRR R RRRRR RRR        I 2322
2323 IRRRRRRRR  RRRR R RR       I 2323
2324 IRRRRRRRR      RRRR        I 2324
2325 I RR RR      RR  RR       AI 2325
2326 IRRRRRR         RR        AI 2326
2327 IRR   R        RRRRR       I 2327
2328 IRRRRR        RRRRR      R I 2328
2329 I  RRRR   RR    R  R     RRI 2329
2330 IRRRRRRR  RR  RRR  RR      I 2330
2331 IRRR RR       R R  RR      I 2331
2332 IRRR  RRR R RR RR  RR  A   I 2332
2333 IRRRRRRRR RR   RR   R AACR I 2333
2334 IRRRRRRR  RRRR RR RRRR   R I 2334
2335 ICRRRR RR CRRRRRRRRRC      I 2335
2336 ICRRRR RR RRRRRR RRRRA     I 2336
2337 ICRRRRRRRRRR RRRRRRR CCR  CI 2337
2338 ICRR RRRRRRCRRRRRRRRRAC    I 2338
      I    I    I    I    I    I
  1981I1986I1991I1996I2001I2006I
```

21

```
FILE: HRD5


  2034I2039I2044I2049I2054I2059I
      I    I    I    I    I    I
2318 IACCCCRRRR RRRCCR      A    I 2318
2319 IRCCRRR RRRRR  CCA    AAAA  I 2319
2320 IRRRRR  R     R  RA   A RCRAI 2320
2321 IRR  RRR    RRR RCC  A      I 2321
2322 IRR    R    RR CRRAAA       I 2322
2323 IR        RR RCRRRRC        I 2323
2324 IRRRR   RRRRRRRRRRRCCCR     I 2324
2325 IRRRRR   R  RRRR RRCC  CAR  I 2325
2326 IRRR     R  RRRRRRRRRRRRAA  I 2326
2327 IRRRR   R   RR RRRRRRRRCC   I 2327
2328 I RRR RRRRR R RRRRRRRCC     I 2328
2329 IRRRRRRRRRR R RRRRRR   CR   I 2329
2330 IRRR         RRRR  R        I 2330
2331 IRRRR RR  RRRRRR   R       RI 2331
2332 IR RR RRA RR  R    R        I 2332
2333 IR RRRRRAACR  R             I 2333
2334 I RRR  R R RR RR    C       I 2334
2335 ICRRRRRR  RR  RR  RR        I 2335
2336 ICCR  RRRRRR  RR  RR        I 2336
2337 IRRCRRRR R   RRR  RR        I 2337
2338 IAAACCRRRRRRRRRRRRRC        I 2338
      I    I    I    I    I    I
  2034I2039I2044I2049I2054I2059I

  21
```

```
FILE: HRD6


  2086I2091I2096I2101I2106I2111I
      I    I    I    I    I    I
2318 I      AA AA  RA      A     I 2318
2319 I ACACCCA  AR C             I 2319
2320 ICRRRRRCRRRRRR RRRRRR A C   I 2320
2321 I RRRRRCRRRRRRRRR   RRRRACCRI 2321
2322 I R  RRRRRR R         R CC  I 2322
2323 IRRRRRRRRRRRRRR     RRRRRR RI 2323
2324 IRR RRRRRR     RRR    RCRC  I 2324
2325 IRRRRR RRRR    RRR RR    CCRI 2325
2326 IRRRRRRR   RR RRRRR     RRRRI 2326
2327 IRRRRRRRRRRR RR   R    RRRRRI 2327
2328 IRRRRRR    RR RRR RRR RRR RRI 2328
2329 I RRRRR     R   R   RRRRRRRRI 2329
2330 I RR RR     RRR RRR    RRRRRI 2330
2331 IRRRRRR   R RRR RRRR     RRRI 2331
2332 IR RRRR   RRRRR  RR      RRRI 2332
2333 IRR RRRR RRRR   RRR    RRR RI 2333
2334 IRR  RRRRRR R RRRRR   RR    I 2334
2335 IRR RRRRRRRR RRRRRR   R R   I 2335
2336 IRRRRRRR RR   R   R   RRR RRI 2336
2337 IRRR RRRRRR      RR  RCCC   I 2337
2338 IR RRRRR      R  R    RRACAAI 2338
      I    I    I    I    I    I
  2086I2091I2096I2101I2106I2111I

  21
```

```
FILE: HR[illegible]


  1981I1986I1991I1996I2001I2006I
      I    I    I    I    I    I
2360 I AA           AAAAAACC   AAI 2360
2361 IARAA RCCRAAAAAAAA AAAARCACAI 2361
2362 I  ARRRRRR   R  CCAR        I 2362
2363 I                     R     I 2363
2364 I  CCR A      C R RRR       I 2364
2365 I  AAAA CRCR R   CC  R    RRI 2365
2366 I RRACR     R RRR  R       RI 2366
2367 I     R  RRRR   R R   RC    I 2367
2368 I     RR                    I 2368
2369 I                           I 2369
2370 I                R          I 2370
2371 I                           I 2371
2372 I         R R            R RI 2372
2373 IRCR     RR   RRC RRCRC    AI 2373
2374 I   RRR  RCRCC  A    AACCCAAI 2374
2375 I  RRRRRRCCA  A        CCARAI 2375
2376 ICR    CAACA  A    AAAAA RCRI 2376
2377 I R CCCRA AAAAA AACRRAAAAARAI 2377
2378 IAAAACCCA A   AAACAAARAAAAAAI 2378
2379 IAARRCCR AAAAA AACAAAAACC  AI 2379
2380 I     RRR CCCAAAAA  A CRRCCCI 2380
2381 IAR    C RCACAR CAAAAR RRA  I 2381
2382 I       AAA CRC  RCAACRCCCARI 2382
      I    I    I    I    I    I
  1981I1986I1991I1996I2001I2006I

  23
```

```
FILE: HRD8


  2034I2039I2044I2049I2054I2059I
      I    I    I    I    I    I
2360 I A     RCA ARR RRR        RI 2360
2361 I A AA  AAAARRRCACCR   AACCCI 2361
2362 I              RRCACRACCCC RI 2362
2363 IR   AAR       R RA CACRRR  I 2363
2364 IRRC CAA          R   ACCRRRI 2364
2365 I    CCC          CR RR    AI 2365
2366 I   RCC            CRR  R  CI 2366
2367 I   RC            CACCCR    I 2367
2368 I  CR   RCA  RACC ACCCCC R  I 2368
2369 I  CRRRCAA AAAR AACCCC CC   I 2369
2370 I RR RRCAARCCCRAA  RCAR C   I 2370
2371 I  C  CCAAAACR RACCCR R C   I 2371
2372 I     A ARACR   RR RRRRCC   I 2372
2373 I   CARCACAC     RR RCRRRCCCI 2373
2374 I RRAARCCACR        C  CRCCCI 2374
2375 I RCACRCAAR    RRAAAR AAAC  I 2375
2376 IC C   RAR     R A AA  ACC  I 2376
2377 IRCRRR  R       CC AA    R RI 2377
2378 I CC      RR    RRRAAACCCC  I 2378
2379 IRRRR  C        RR RCACRCRCRI 2379
2380 I CCR  RR         CR  ARRC  I 2380
2381 IRCCC  RCRR    RRAA ACA  AARI 2381
2382 ICCCCRRCR        RCCAC R ACCI 2382
      I    I    I    I    I    I
  2034I2039I2044I2049I2054I2059I

  23
```

FILE: HRD9

```
  2086I2091I2096I2101I2106I2111I
      I    I    I    I    I    I
2360 IAAAAAAC ACA  A       A    I 2360
2361 IAAA  AAAAACA A        RCA I 2361
2362 I AAA A AACCC ACCCC A  RRAAI 2362
2363 IAACAAAAAAARRC     AACRCCR I 2363
2364 I CCCAAAARA  R   CCCRRCAR  I 2364
2365 IACCCACCAAC  A   RRCRRA A  I 2365
2366 ICACCCCCCCCRRRC  R RR   R  I 2366
2367 IAAARCCCCCCCCRRRR RRRRR RR I 2367
2368 IA AACCCCRRCCCRRRRCCRCR RR I 2368
2369 IAACCCCCRR RRRRRRRRRR CAAC I 2369
2370 ICACRRRRRRRRRRRRR RRR CA ACI 2370
2371 IACRRRRRRRRRRRRRRRRRR CHAAAI 2371
2372 IAR RR RRRRRCRR   RRRRRCCRRI 2372
2373 ICCRCCRRRRRR  R  RRRRRRRRRCI 2373
2374 IR  CR   RRRR    CCR    RRRI 2374
2375 ICR  C RRR RRRR   CRR  RRR I 2375
2376 I     CC  RRRC  CR  CR  R RI 2376
2377 IR   CCR RRRRCCRR   R  RRR I 2377
2378 I      RR RRRRC         RRRI 2378
2379 IAR     CCR  R R      RCRCCI 2379
2380 IA        RR  RC     R CCRRI 2380
2381 IC        CCR  C        RRCI 2381
2382 I         RR         R RRCRI 2382
      I    I    I    I    I    I
  2086I2091I2096I2101I2106I2111I
```

23

ORIGINAL PAGE IS
OF POOR QUALITY

FILE: SD1

```
  2162I2167I2172I2177I2182I2187I
      I    I    I    I    I    I
1937 I     CCCCCCACCC     C     I 1937
1938 I    CCCCCCCCRCC     A   R I 1938
1939 I     CRRRRCRRRA     A     I 1939
1940 I     CC RCCRCCCC        R I 1940
1941 I R RC   CCCRCARC    R   R I 1941
1942 I C CCCCC    C  C         RI 1942
1943 ICCCRR CC   A  AACAA       I 1943
1944 ICRR  RCR   A CR CR A      I 1944
1945 ICCCR CCR R  RR   CRCR   R I 1945
1946 ICCCR  RCCR   R   CR R    RI 1946
1947 IRRCC  RR         RAC   RR I 1947
1948 IRRR      R        R       I 1948
1949 I  CRR             RAA     I 1949
1950 I R                CAA     I 1950
1951 I   R       RCR    CRC   AAI 1951
1952 I   R       RCCR CC      ACI 1952
1953 I  RRR      RCCCR R     RC I 1953
1954 ICCRR        RCCRC RCCA  CCI 1954
1955 IA RRR   R  R  RRCACACAAACRI 1955
1956 I RCCCCCCCRCR CRRCACACCCC CI 1956
1957 ICCC  R   RCRRRRCCCC CAACCCI 1957
      I    I    I    I    I    I
  2162I2167I2172I2177I2182I2187I
```

21

FILE: SD2

```
  2214I2219I2224I2229I2234I2239I
      I    I    I    I    I    I
1937 I RAAR  RRA     AAAAACAAC  I 1937
1938 I  CA RR RA      AAAAAAA C I 1938
1939 I     R RAAAAA    AAAAAA ARI 1939
1940 I        RCCAA  ARCACCAAAARI 1940
1941 IC       RAC AAAAAAAACCCCR I 1941
1942 I      RR RAAAAAAA RCCCACR I 1942
1943 IR      R AACCAAAAAACAARCR I 1943
1944 IR      RARCAAAAAAAACAARCC I 1944
1945 I       CRRAAA   AAAAACCCC I 1945
1946 I      RRRRC A    AACCAAACRI 1946
1947 I         RRRAA    AAA AAC I 1947
1948 I           CCAA        AR I 1948
1949 I            R CAA    AAAC I 1949
1950 I            CRRAA    AAAC I 1950
1951 I             RAAAAAA   AA I 1951
1952 I            RRAAAAAAAA AARI 1952
1953 IRR      RR RCAAAAAAAAA A RI 1953
1954 I RR     R RCCCAAAA A  A C I 1954
1955 I R     R  RRRCAAAAA  AAAC I 1955
1956 IR      RRCCCCAC      A    I 1956
1957 IRR       R RAAA    A     RI 1957
      I    I    I    I    I    I
  2214I2219I2224I2229I2234I2239I
```

21

FILE: SD3

```
  2162I2167I2172I2177I2182I2187I
      I    I    I    I    I    I
1978 I   A           R    C     I 1978
1979 I            RR AC   RCC ACI 1979
1980 I          AAA AACRRRC CC CI 1980
1981 I          R RA   ACAA    CI 1981
1982 I           CCCC AACC     AI 1982
1983 ICR         CA  CR         I 1983
1984 IAR                       CI 1984
1985 IA R     RCR              RI 1985
1986 IACR     RCA     R  R     RI 1986
1987 I  C    RCA   RRRCC R      I 1987
1988 I   CC A      RRCCA   R   RI 1988
1989 I    A      R  RRAA  RR    I 1989
1990 I RR        RR    RRR      I 1990
1991 I                RR RRR R RI 1991
1992 I                 R     RR I 1992
1993 I                 RRRR   R I 1993
1994 I                  RRC    RI 1994
1995 I                          I 1995
1996 I                       RRAI 1996
1997 I R         R       R   RCCI 1997
1998 I R   CR    RR RR       RRRI 1998
      I    I    I    I    I    I
  2162I2167I2172I2177I2182I2187I
```

21

FILE: SD4

```
  2214I2219I2224I2229I2234I2239I
      I    I    I    I    I    I
1978 IC     AA  AA A     ACCACCCI 1978
1979 IC           A        CCA CI 1979
1980 I                     CCRCCI 1980
1981 I   A             R      RCI 1981
1982 I                A A    CC I 1982
1983 I               ACCCA    RCI 1983
1984 I               ACC A     AI 1984
1985 I                  A  A  ACI 1985
1986 I     R             AAA  CCI 1986
1987 I     R                  CCI 1987
1988 I                      A CRI 1988
1989 I             A          C I 1989
1990 I              A   AA  A   I 1990
1991 I               CAA    A  AI 1991
1992 I                A A       I 1992
1993 I        R                 I 1993
1994 IA       RR R R           RI 1994
1995 IA        RRRR            RI 1995
1996 IACCAA    R                I 1996
1997 ICACCC    RC R R          RI 1997
1998 ICAAA  RRCCRC R           RI 1998
      I    I    I    I    I    I
  2214I2219I2224I2229I2234I2239I
```

21

FILE: SD5

```
2021 IR RRRRRRRRRRRRRRRR RRRRRRRI 2021
2022 IRRRRRRRRRRR RRRRRRR RRRRRRI 2022
2023 IRRRRRRRRRRRRRRRRRRRRRRRRRRI 2023
2024 I RRRR RRRRRRRRRRRRRRRRRRR I 2024
2025 I R RRR RRRRRRRRRRRRRRRRRRRRI 2025
2026 I RRR   CRRRRRRRRRRRRRRRR   I 2026
2027 IRRRRA     RRRRRRR RRR RR   I 2027
2028 ICCRRRR  RRRRRRRRRRRRRRRRR I 2028
2029 IRC RRRRRRRRRRRRRRRRRRRRRRRI 2029
2030 IRCCRRRRR RRRRRRRRRRRRRRRRRI 2030
2031 I  C    R  RRRRRRRRRRRRRRRRI 2031
2032 IRCRRRRRRRRRRRRRRRRRRRRRRRRRI 2032
2033 IR RRRRRRRRRRRRRRRRRR RRRRRI 2033
2034 IRRRRRRRRRRRRRRRRRRR  R RR   I 2034
2035 ICCCRRRRRRRRRRRRRRRRRRRCRR   I 2035
2036 ICCCRRRRRRR  RRRRRRRRRCCR    I 2036
2037 ICRCRRRR     RRRRRRRCCRR     I 2037
2038 IRC  RRR     R   RRRRRCRR     I 2038
2039 IRR RRRR  R      RRRRRRRR     I 2039
2040 IRR RRRRRRRRRR RRRRRR        I 2040
         I     I     I     I     I     I
      2162I2167I2172I2177I2182I2187I
```

19

FILE: SD6

```
      2214I2219I2224I2229I2234I2239I
          I     I     I     I     I     I
2020 IR R    RCCCRRCCR          A   RI 2020
2021 IR   R   RRCCCCCRC          C   RI 2021
2022 IC RRRR    RRRRRC          RRR I 2022
2023 I  RCRR   RCRR        R    R   I 2023
2024 I    RR   RRR         R        I 2024
2025 IRR             R              I 2025
2026 I          R   RR              I 2026
2027 IR              CC             I 2027
2028 IC         RR  RCC           RI 2028
2029 IR                  RR         RI 2029
2030 I                    R       RRI 2030
2031 ICC     RR           RCRRRRR   I 2031
2032 IC   RR R            R RRRR    I 2032
2033 IC    R              R  RRRR   I 2033
2034 ICR R             R  RCRRRRRR I 2034
2035 ICR               R      RRRCRRI 2035
2036 I RR                   R R RCCCI 2036
2037 I                              I 2037
2038 I  R                           I 2038
2039 IRR                       RR   I 2039
2040 IC                          R  I 2040
          I     I     I     I     I     I
      2214I2219I2224I2229I2234I2239I
```

21

FILE: SD7

```
      2162I2167I2172I2177I2182I2187I
          I     I     I     I     I     I
2062 I            R  A   AAA        I 2062
2063 IR             AA            R  I 2063
2064 I               AA      A       I 2064
2065 I     AAA AAA AAA  A       R   I 2065
2066 I         AACAR AAAA   ARCCCCI 2066
2067 I      A     AACR AAAA  AA   CI 2067
2068 I        AA ACCC        A ARRR I 2068
2069 I     AAAAC RRCCCRC     AAA AI 2069
2070 I    AAAAA RCRRCCCRC  ACCR CI 2070
2071 IA CRA ACCRRCRRRRRRCRCR  RCI 2071
2072 I CRRCRRRRRRRRR CCRRRCCR    I 2072
2073 ICRRR     RRRR   RCRRR RRCCRI 2073
2074 IAR RR RRRRR           RRRR RI 2074
2075 IA    R RRR          R R  R    RI 2075
2076 IAC RRRRRRR          RRRRRR  RRI 2076
2077 I  C  RRRRRR           R  R RRRI 2077
2078 I CRRRRRRRRR  R  RRRR  RR  I 2078
2079 I RRC R RR      RRRRRRRR RR RI 2079
2080 I C     R  RRRR R RRRRRRRCCCI 2080
2081 I RRCCCRRCCCCRRRCRRRRCRRRRCI 2081
2082 I  RRCRCCCCRRRRRRRRRRRRRRRRRI 2082
          I     I     I     I     I     I
      2162I2167I2172I2177I2182I2187I
```

21

FILE: SD8

```
      2214I2219I2224I2229I2234I2239I
          I     I     I     I     I     I
2062 I RCCRRRR RRRRRC    RRR   R RI 2062
2063 ICCRRCCCCCR RRRCCRR           I 2063
2064 I  RRC CCRRRRRRCRCAAA    RR I 2064
2065 IA RCCRCCCCCCR CCCCCACCCCC I 2065
2066 IR RC     RCRR RRRRRAC      ARI 2066
2067 IAC        RCR CCCCACA       AAI 2067
2068 I RR R             C RRC         I 2068
2069 IACCCR R         R C A           I 2069
2070 ICRR     R        C R  C          I 2070
2071 IRCR    CCC       RR   C         I 2071
2072 IRCRRCR RC R   RRC RC           I 2072
2073 IC C    CCRCCRRRCCCCR R         I 2073
2074 IA R    CCRCCCCCCCR              I 2074
2075 I          CRRRRCR  R             I 2075
2076 IR  ARCCRRRCCC    A             I 2076
2077 IR A      R RRR    R             I 2077
2078 IRARAA       CRR R R             I 2078
2079 IR   R   CA CAARCC           AC I 2079
2080 IR    R      CCRR                CI 2080
2081 ICRRCC     ACCRCA A          A  I 2081
2082 IRRR C   ARRRR AA     CRR   R I 2082
          I     I     I     I     I     I
      2214I2219I2224I2229I2234I2239I
```

21

FILE: CCD1

```
  2017I2022I2027I2032I2037I2042I
      I    I    I    I    I    I
1791 ICAAAAAAAAAC     C CCCCA  AI 1791
1792 I  AAAAAAAAA     R    CR   I 1792
1793 IR AA AAAAAA      R R      I 1793
1794 IR ACR   AA  CA   RC       I 1794
1795 IRR        A   A  A        I 1795
1796 IRR       RA     A         I 1796
1797 IRRRC         A AC         I 1797
1798 I CR       A    A          I 1798
1799 I AAR   AAAAA AAAAC        I 1799
1800 IA  C    AAAAAA AAC        I 1800
1801 I  C    AAAAA  AA          I 1801
1802 I      RAAAAAAAAA          I 1802
1803 IAAA     AA AAAAA R        I 1803
1804 IAAA      A A AARR         I 1804
1805 IAAR    R RR AAARR  A      I 1805
1806 IA        RAAAAAAAAAAA A   I 1806
1807 IC        AAAAA AA     A   I 1807
1808 I R         AAAAA       R  I 1808
1809 I  R          AAAAAA    A  I 1809
1810 I AAR       A A     A AACCAI 1810
1811 IAAC        A  A   A  RRR AI 1811
      I    I    I    I    I    I
  2017I2022I2027I2032I2037I2042I
```

21

FILE: CCD2

```
  2069I2074I2079I2084I2089I
      I    I    I    I    I
1791 IAAR        ; A CAAAAA R AI 1791
1792 IAAR          RCAAAAAA A  I 1792
1793 IA            RC AAACAA   I 1793
1794 IAC        RR R RR ACCCR  I 1794
1795 I     A  RR   RRRAAAAARCCCI 1795
1796 I  RRCRCCC    RCCARAAAA ACI 1796
1797 I  RRCRA C     RAAAAA AAACI 1797
1798 I  CC ARCR        A   AA CI 1798
1799 IRCR             AAA   A  I 1799
1800 I RCR   RRR       AAAAAA  I 1800
1801 IRRRRRRRCCC       AAAAAAR I 1801
1802 ICRRRRR  CR     AAAAAAAAAAI 1802
1803 IRRRRRR     CR  A AAAAAAAAI 1803
1804 ICRRRRRRR R R   R     AA  I 1804
1805 IARC R   RC AAA C       A I 1805
1806 IAAAA  C  RR  AAAC C  AAAAI 1806
1807 IAAAAR  AA AC AAA   AAAAAAI 1807
1808 IAA A  RC  CAAAACR  AA  AAI 1808
1809 I A A     AA AAAA C   AA  I 1809
1810 I AA A     RR   AAA  AAA  I 1810
1811 IR  AA     R R   A    AA  I 1811
      I    I    I    I    I
  2069I2074I2079I2084I2089I
```

21

FILE: CC[illegible]

```
  2121I2126I2131I2136I2141I2146I
      I    I    I    I    I    I
1791 IRCC AAACCC R  R     C     I 1791
1792 IRC   AA  CRRR R     AR    I 1792
1793 IA     A  R RRR   RRCA     I 1793
1794 IC  RCRRR    RRRRRRRC      I 1794
1795 IC  RCR         CCCCC      I 1795
1796 ICCCCCCR C     CRC         I 1796
1797 IRRRCR CAA     RRR   C     I 1797
1798 ICACCCRRRCA   RRRRRRC  A   I 1798
1799 IACCCACCR    R   CCR       I 1799
1800 IRCCCR               C RCRRI 1800
1801 IC CCR              CC  CRRI 1801
1802 IR RCRR                RRRRI 1802
1803 ICC RR                 RRR I 1803
1804 ICCCCR R           RR RRRRRI 1804
1805 ICACCCRRRR  CC     AC      I 1805
1806 I RRC A AA ARRR     A      I 1806
1807 IARCAAAAA    RCCC          I 1807
1808 IR AAAAAAAA R RCRR  RR     I 1808
1809 IAAAAA  AA   CR    CRR RC  I 1809
1810 IAAAAAAAAA ARRRRCR RA CRC  I 1810
1811 I RRRAAA   A      C   RC   I 1811
      I    I    I    I    I    I
  2121I2126I2131I2136I2141I2146I
```

21

FILE: CCD4

```
  2017I2022I2027I2032I2037I2042I
      I    I    I    I    I    I
1833 IRRR RR            CCR     I 1833
1834 IRR  RRR            RR    RI 1834
1835 IRCCRRR    R             RRI 1835
1836 IRCCRRRR  RR      RCR     RI 1836
1837 IRRRRRRRRRRRRR R    R R RRRI 1837
1838 I  RRRRCRRRRCRRC         CRI 1838
1839 I    RRRARRCCCCC         CCI 1839
1840 I     RRRRRCCRRC          CI 1840
1841 I     RRRRRRCRR          ACI 1841
1842 I   C   R  RRRRR         CRI 1842
1843 IRCCCCC    CR  RC         RI 1843
1844 ICCRCCCR   CC              I 1844
1845 ICRRRRR  R  C    RRC       I 1845
1846 I RR RRRRR       CC CR     I 1846
1847 IRRRRRRCR   C   RR       RRI 1847
1848 IRRRR AC RRRR         CR  RI 1848
1849 IRRRR   RRR              RRI 1849
1850 IRRRRRR CR               RRI 1850
1851 IRRR RRCA   R            RRI 1851
1852 IRRRRRR     CC ACA        RI 1852
1853 IRRRRRRR RRRC     A        I 1853
      I    I    I    I    I    I
  2017I2022I2027I2032I2037I2042I
```

21

FILE: CCD5

```
  2069I2074I2079I2084I2089I
      I    I    I    I    I
1833 IA  AACRACR CC CCCCCCCCRRAI 1833
1834 IAAAACRRCACRCC RCRRCCCR  AI 1834
1835 IAACRRRRRRRRRACRRRCCCCR   I 1835
1836 IRRRRCCRRRRRARRCCCRRR     I 1836
1837 IR CR CCCCCC  A A         I 1837
1838 I        CR  AAA R        I 1838
1839 I        CRR              I 1839
1840 I        CRR           R RI 1840
1841 I     RR   R           RCCI 1841
1842 IRRC  CCRR  AAA           I 1842
1843 I C C  RCRRR AA          AI 1843
1844 I       CRR RAAA         CI 1844
1845 IR  RCRCCR  R  AA      AACI 1845
1846 IRR   CCCRCCR   A      CCRI 1846
1847 IRR   CCCRCCCR  AAACR  CRRI 1847
1848 IR     CACR  CC     CARR RI 1848
1849 I  RRR R RR CC        R RRI 1849
1850 IRRRR    R   CRR R    R RRI 1850
1851 IRCC       R RRRRRRRR   RRI 1851
1852 I R  R  R RCRRRRR R  RR   I 1852
1853 I  R    RC CRRRR R  RRR   I 1853
      I    I    I    I    I
  2069I2074I2079I2084I2089I
```

21

FILE: CCD6

```
  2121I2126I2131I2136I2141I2146I
      I    I    I    I    I    I
1833 I RRRRR  R   R    R    A   I 1833
1834 I RCRRC R       R  A       I 1834
1835 I  RRCC          AC        I 1835
1836 I  R  C   CC    CRC     R  I 1836
1837 I        A   AAAACCCACCRRRRI 1837
1838 IRC   RRACA CCAAACCRRRR R  I 1838
1839 IC    RRRRA ACAACCCRRCR   RI 1839
1840 IC  RRRRRRRRRRRRRCCRR    R I 1840
1841 I   RRRRRRRRCRRCRCCC       I 1841
1842 I RR  R RRCR CCRCCCCRR    RI 1842
1843 I RR    RRC RCRRRRRCRRRRRR I 1843
1844 ICRRRRR RRRCRRRRR RCRRRRRR I 1844
1845 ICCRRRRRRRRRRRRRRRRR CCRR  I 1845
1846 ICCCRRRRRRRRRRRRRR RRRRCA  I 1846
1847 IR RCCCRRRRRRRRRRRRRRRR    I 1847
1848 IRRCCRCCRR   RRR R RRR     I 1848
1849 IRRC RRRRRR     RR    A RRCI 1849
1850 I  RRR  R R             RRRI 1850
1851 I  RRR  R             A R  I 1851
1852 I  RRRRRRR             R RRI 1852
1853 IRR  RRRCC R    C AR  ARCCCI 1853
      I    I    I    I    I    I
  2121I2126I2131I2136I2141I2146I
```

21

FILE: CCD7

```
  2017I2022I2027I2032I2037I2042I
      I    I    I    I    I    I
1875 I           RRRRRRRR   CCRRI 1875
1876 I            RRRRRR   CRCRCI 1876
1877 I  AAA       RRRRRR  RCRCCCI 1877
1878 I A   AAA A  RRRRRC  RCCCCRI 1878
1879 I   CC  ACCCCRCRC C R RCRCCI 1879
1880 IR    RRCRRCCCCRRRRC RRR  RI 1880
1881 I  R  CCCRCCCCRCC RRCCR  RCI 1881
1882 I RCR C   ACCRRCCRRRRRCR   I 1882
1883 IRCRRRRAA ACAACC RRRCCRR   I 1883
1884 IRCCC RCA AAAACCA RRRRRRR  I 1884
1885 ICRC  R  C A CCCCCCRRRRRC RI 1885
1886 ICCR  RRRC AACCCCCACRRRRRRCI 1886
1887 IRCCCRCRCC  AACCRCCCCRRRR CI 1887
1888 IARRC  RC A     R RCCCCCCRRI 1888
1889 IR RCR RRR       RCCCRR RCRI 1889
1890 IR  R RR          RRCCR  RRI 1890
1891 I          RC  R R  RRRR  RI 1891
1892 I         RCCAACCR   RR    I 1892
1893 I        RRRCCCCRR  RRR R RI 1893
1894 I        R  RRRRRR RRR  RCCI 1894
1895 I AA      R  RRCRRRRRCCRRCRI 1895
      I    I    I    I    I    I
  2017I2022I2027I2032I2037I2042I
```

21

FILE: CCD8

```
  2069I2074I2079I2084I2089I
      I    I    I    I    I
1875 IRRCRRR     RR RR         I 1875
1876 IR       RRRRRRR          I 1876
1877 I   RR RRCRRRRR   R       I 1877
1878 I RRRRRRRRRRRRRC  R       I 1878
1879 I  R R RR   R RA  R RRRR  I 1879
1880 I R   A     A    RRRRRRRRRI 1880
1881 I  R  CR        RRRRRRRRRRI 1881
1882 I              RCRRRRCR  RI 1882
1883 IR       R   RRRRCCCRCRRRRI 1883
1884 IR  R    R   RCRRRCCRRRRRRI 1884
1885 IA   CRRR A   CRRRCCCRRRRRI 1885
1886 I   RR  RARA  CRRRRRCRR   I 1886
1887 IR        A   CRCRCCCCRR  I 1887
1888 IR    R     RA  CRCACCR   I 1888
1889 I   RCR     C  RC  RRRRR  I 1889
1890 I RR  R           RRR     I 1890
1891 I    AAC          R       I 1891
1892 I    ACAAAAC         C CR I 1892
1893 I RR  CCCRRCR         CRR I 1893
1894 IRRRRRRRRRRCR  A      RC  I 1894
1895 IRRRRRCRRRRC C C      A  AI 1895
      I    I    I    I    I
  2069I2074I2079I2084I2089I
```

21

FILE: CCD9


```
  2121I2126I2131I2136I2141I2146I
      I    I    I    I    I    I
1875 I R A R          RCRRRRRRRCI 1875
1876 IR ACRR           CRRRRRRCRI 1876
1877 I  A R           RCRRRRRCCRI 1877
1878 I ARR            RRRCCRRRRRI 1878
1879 I   R     R      RRRRCRRCCRI 1879
1880 I   RCRRCCRRRRRRRRRRRR CCAAI 1880
1881 I CRRRRRCRRRRRRRRRRR    AA I 1881
1882 I  RRRRCCRCRRRRRRRRCRRRCAA I 1882
1883 IC RRRRRCRCRRRRRCRRCACCCAAAI 1883
1884 ICRCCRCCCRCCRCCRCRCARCCCRAAI 1884
1885 ICCCAACRC  RRRCRRCCR       I 1885
1886 I      RRRR RRCCR      CA  I 1886
1887 I      R     CCCRRR   RCCAAI 1887
1888 I    A      AACCCCR   CCCARI 1888
1889 I   AC      AARCCCRC CCCRRCI 1889
1890 IRRRR    AAC  RRCCRRCRCCCACI 1890
1891 IR RRRRRRRCCCCR R R   RRCCCI 1891
1892 IR  RRCC RRRCRR       C RAAI 1892
1893 IRRRCCRRRRRRC       RRC  ACI 1893
1894 ICRCCRRRRRRRRR     RRRCAAACI 1894
1895 I  CRRRR RRRR        RCRRC I 1895
      I    I    I    I    I    I
  2121I2126I2131I2136I2141I2146I

 21
```

FILE: LD1

```
  1798I1803I1808I1813I1818I1823I
      I    I    I    I    I    I
2276 ICCRCCCCCCCCCCRC          A AI 2276
2277 IRRRRRRCCRCCR             C  I 2277
2278 IACRCCCR RCCRR            A  I 2278
2279 IACCC RRRRRCC        R A    AI 2279
2280 ICCCCAAAR                    I 2280
2281 IRCRRARC  AC    AC           I 2281
2282 IRR ACACCCARRR  CCR  A      AI 2282
2283 IR CCCCCR CRR  RR   CCCC    AI 2283
2284 IRR RC CRCCCCR          RRCR I 2284
2285 ICCCRC ACCC CCCRRR           I 2285
2286 IAAACCAAAARR RRRCC          CI 2286
2287 IAAACCC    R  RR  RRR RA     I 2287
2288 IAAACRRRCCC   ACC  CCAA   RRI 2288
2289 IAARRAA AACCCCC RCCCCCCACAAI 2289
2290 ICCACRCCA CACRCCRCACCCRCCC I 2290
2291 ICCACACRCC RRCCCCCACCRRRRRRI 2291
2292 ICAACCA CCCCCRCRRCCCCR   R I 2292
2293 I AAACAACACACCRCCRRCCR  RR I 2293
2294 I  CA CCCCCCCCRRCCCCCCCCRR I 2294
2295 I    CCACCCRR CCCCCCCCCCR  I 2295
2296 I   RRRARRRR  RC  RCCRRRRR I 2296
      I    I    I    I    I    I
  1798I1803I1808I1813I1818I1823I
```

21

FILE: LD2

```
  1851I1856I1861I1866I1871I1876I
      I    I    I    I    I    I
2276 I          CC  RCRCCCRRCACRI 2276
2277 I          RR    RRC CRRRR I 2277
2278 I                          I 2278
2279 I     CCRRRR               I 2279
2280 I     C RRRRRC R           I 2280
2281 ICCCRCRRCCCRRCRR     R     I 2281
2282 IRRCCCCAACAARC  RR  R  R   I 2282
2283 ICCCCCA     ARC            I 2283
2284 ICCCAAACA   R  RC RCR      I 2284
2285 IRCCA CCCC RC        R     I 2285
2286 ICRRCCCCCRCR               I 2286
2287 I RCRCCCRC  RRR      R     I 2287
2288 I  CRRRCRR   RR    R R     I 2288
2289 IR  RCCRRCCRCCCRRRRRR RRRR I 2289
2290 I RRRRRCCCR RR R  CCCR   R I 2290
2291 I     RCRCCC A R   CRRRR   I 2291
2292 I     RRRRC    R     C     I 2292
2293 IRR  RR RR RRCRRR         RI 2293
2294 IACARRRRRR  RRRRRR        RI 2294
2295 I RRRR    RRRRRRR  CCCCRR  I 2295
2296 IR  RRRRRRR  RRRCCCRRRRRRR I 2296
      I    I    I    I    I    I
  1851I1856I1861I1866I1871I1876I
```

21

FILE: LD3

```
  1903I1908I1913I1918I1923I1928I
      I    I    I    I    I    I
2276 IRRRRR   AAA      R       C  I 2276
2277 I RRRCRA        R    RR      C I 2277
2278 I RRRRRC     R                 I 2278
2279 IRRRRRR   A  A                 I 2279
2280 I RRRRRCRR   A      C          I 2280
2281 I RRRRRRAA     R    R          I 2281
2282 IRRRRR  CA     R    R    A   AAI 2282
2283 IRRRRRRACA     R    R  C    A  I 2283
2284 IRRRRRRRAA     AR   CR         I 2284
2285 I    R AARA         RR     RR  I 2285
2286 I   RRRRCRC       R  R    R    I 2286
2287 IRRRRRRRR          RRR         I 2287
2288 I R RR        RR RRR           I 2288
2289 I     RR     RRR               I 2289
2290 IR    RR     RRR         A     I 2290
2291 IRRRRRRR      R  A             I 2291
2292 IRRRRRRR    RRC  CA            I 2292
2293 I RRRRR  RRRRR    A A          I 2293
2294 IRR   R R    RP                I 2294
2295 I RRR                          I 2295
2296 I RCR                          I 2296
      I    I    I    I    I    I
  1903I1908I1913I1918I1923I1928I
```

21

FILE: LD4

```
  1798I1803I1808I1813I1818I1823I
      I    I    I    I    I    I
2318 I CCRC     R    RRAACCCRR    I 2318
2319 IAC             CRRR    CCRC I 2319
2320 ICC  R R        R    RCCCCC AI 2320
2321 I CCCRRCCCRRRR RCCCCCCCAAA I 2321
2322 I   AACCCCCR RCCCCCAACCAACA I 2322
2323 I    CCC        CA     AAAC AAI 2323
2324 I       R CR  A     AA AR    RI 2324
2325 IRCARCR  ARCACCCCRCRCC   R RI 2325
2326 ICC  RA CCACR RRCCR     RRCAI 2326
2327 ICR  CACRCRCC CCA RCCCCRRRCI 2327
2328 IRRRC  RRCCCRRCCA C RRRRAACI 2328
2329 ICCCC  RCCCCRR    CRRRRRRRRRI 2329
2330 ICCR  RC  C  CA    ACRRRRRCCI 2330
2331 ICCRRR        RACC    CR RRR  I 2331
2332 I  C  C          CCC          I 2332
2333 I       R            CR       I 2333
2334 IR      C                     I 2334
2335 IR      CR    R               I 2335
2336 IAC    RRCCRCA                I 2336
2337 I  AAC ACC                    I 2337
2338 IA               CRRR         I 2338
      I    I    I    I    I    I
  1798I1803I1808I1813I1818I1823I
```

21

FILE: LD5

```
  1850I1855I1860I1865I1870I1875I
      I    I    I    I    I    I
2318 I      RRRR RRRRRRRR R  RR I 2318
2319 IA     RRR R  RRRRRRRR     RI 2319
2320 IA    RRRRRC  RRRRRRR R    RI 2320
2321 IC CCCRCCRRR RRRRCCR R     RI 2321
2322 ICCCCRRRC R    RRRRRRR      I 2322
2323 ICCRRRRRR RR    R     RR R  I 2323
2324 IRRRRRRRRRRRR R       R    RI 2324
2325 IRRRRR  RRR RR     RR   R  RI 2325
2326 I     RRRRR R        RRRR  RI 2326
2327 IR R R   RRRR  RRRRR RR     I 2327
2328 I  RR RR  R  RRRRRRRRR     RI 2328
2329 IRRRR RRR  RRRR RRRRRR      I 2329
2330 IRRRR RRRRRRRR RRRR       R I 2330
2331 IRRRRCRRRRR    RRRRRR      RI 2331
2332 IR R    RRRRR  R     R  R RI 2332
2333 IRRRRC  RRRRRRR          RRI 2333
2334 IRRR       R RRRR        RRI 2334
2335 IRRR      RR   RR R   RRRR I 2335
2336 IR R     RRR  RRRRR     RRRI 2336
2337 I  R C RRRR   RRRRRR      R I 2337
2338 I  CRCRRRRRRRRRRRRRRCRRR RRI 2338
      I    I    I    I    I    I
  1850I1855I1860I1865I1870I1875I
```

21

FILE: LD6

```
  1903I1908I1913I1918I1923I1928I
      I    I    I    I    I    I
2318 I RR R    ACRCRRCCCR R  RRRI 2318
2319 IRRR        CRCCCCA   RR RRI 2319
2320 I    R        CC  A   R  RRI 2320
2321 I   R R       RC         RRRRI 2321
2322 ICR RRR   R  R       RRRRRRRI 2322
2323 I         R RCR RR  RR RRR I 2323
2324 I             RARC  RRRRRRRI 2324
2325 I             AAAR  RRRRRRRI 2325
2326 I      R R      AACA RRR RRRI 2326
2327 I              A     CRRR  RI 2327
2328 I                  R  R    RI 2328
2329 I   CCA         AAC  C  RRRR I 2329
2330 I  CCRA     AA          R R I 2330
2331 I  CCRR    A RR          RRRRI 2331
2332 I  A        RR      AAAR CRRI 2332
2333 I A   A              A ARCCRRI 2333
2334 I     AC    R       A ACC RRRI 2334
2335 I    R      RRRR      AAA     I 2335
2336 I  A        RRRR              I 2336
2337 IRA    A         AA AAAAR     I 2337
2338 I          A       AAAR A    CI 2338
      I    I    I    I    I    I
  1903I1908I1913I1918I1923I1928I
```

21

FILE: LD7

```
  1797I1802I1807I1812I1817I1822I
      I    I    I    I    I    I
2360 IRRC      CCC AC AAA CCCRCCRI 2360
2361 I        RRCAAAACCCCCCCCCCCCI 2361
2362 I        RRRCRACCCCAACCCCCCAI 2362
2363 I          RCCCC      RCCRCCAI 2363
2364 I         CCCCC      RCRRCCCI 2364
2365 I   CCAA CCCCCCC      CCCCCCCI 2365
2366 IA     R     RCA             CI 2366
2367 ICRRRRRR  RCCC  AA            I 2367
2368 IRC  RRRCC  R R     A  CC AAI 2368
2369 IACAARRRR     AA      RCCARCCI 2369
2370 I CC CAAR              RRRRA CI 2370
2371 IR R CCCC      AAC RCCRCRA AI 2371
2372 IR  RRRRRR  CCCCCCCAACRC RCI 2372
2373 ICCRRCCCRCCRCCCCCCCCCC RR RCI 2373
2374 IRCCCCCCCCCCC    CCRRRRC   CI 2374
2375 IRCCR     CCR RC RRRRRRCCCRRI 2375
2376 ICCCC RCRRRRRR      AARCCRRRI 2376
2377 I   CR  CCR  R       AACRC CI 2377
2378 IRRRR         RR          CCRCI 2378
2379 ICRRRRR RRRR RRR  R     AA AI 2379
2380 IRRRRRR   RRRCR     RRRR RA AI 2380
2381 I      RR RRCCCRR  AR    RAAAI 2381
      I    I    I    I    I    I
  1797I1802I1807I1812I1817I1822I
```

22

FILE: LD8

```
  1849I1854I1859I1864I1869I1874I
      I    I    I    I    I    I
2360 IRR RC ACCCAR   R     CCCCR I 2360
2361 IACR AAA  C        RR RAAC  I 2361
2362 IACRAA ACR  R              CRI 2362
2363 ICRCC RC                 R RI 2363
2364 ICCRCCCC           C AAC R CI 2364
2365 ICCCCCAR          C  AR    RI 2365
2366 ICCCCACR A RAA  R   ACC   CI 2366
2367 ICCRCAAA   RCAAAC  RCC   R I 2367
2368 ICC RCC C  AAACC   A RR     I 2368
2369 ICC RAA  A   A  ACCCCCC CR I 2369
2370 I   CAAAA        AA AACRCC  I 2370
2371 I  AA   R  RA           R  CCI 2371
2372 I    C    RC                 I 2372
2373 I    AC      CRC             I 2373
2374 I A CRR     CRA              I 2374
2375 I A      RAAR                I 2375
2376 I                            I 2376
2377 I                            I 2377
2378 I                            I 2378
2379 I                            I 2379
2380 I                            I 2380
      I    I    I    I    I    I
  1849I1854I1859I1864I1869I1874I
```

21

FILE: LD9


```
  1901I1906I1911I1916I1921I1926I
      I    I    I    I    I    I
2360 I  CR              RA   R  I 2360
2361 I   A A       RR    RCCC   I 2361
2362 IAAAAAA    R       RRRRRRC I 2362
2363 ICCACA               RCC CRI 2363
2364 I   AA               RRR   I 2364
2365 I R  A             RRC     I 2365
2366 IR     R        R   C      I 2366
2367 I     RR      RCC  RC     RI 2367
2368 IA    RR     RCRCRRCR      I 2368
2369 I AACR     R RCR  R        I 2369
2370 I R CR    RCCC R   R     R I 2370
2371 IRRRR RRRRCRRCC       R  R I 2371
2372 ICRRRCCCCCAAAACCCCCCCC   CCI 2372
2373 IC      RCCCC A ACCACCCR RCI 2373
2374 I  RRRC CCRRC RCCACCCCCR CRI 2374
2375 I CCRRRCRRCCCCCCCCCCCCCC CCI 2375
2376 I RCCRR   CCCRCRCCCCCCCR CRI 2376
2377 I   CC  R RRCCR CCCCCRCRC  I 2377
2378 I RCRCRC    RRRRRCCCCCCACCCI 2378
2379 I R  RRR         CCCCCCCACCI 2379
2380 IA            RRRRRCCCACCCAI 2380
      I    I    I    I    I    I
  1901I1906I1911I1916I1921I1926I
```

21

Appendix G

Results of ABSTAT - Confusion Tables

These data represent the individual confusion tables which were computed by ABSTAT using the test pixels identified by TEST@. They are in the following order:

PHASE ONE - BLOCKED

ORIGINAL PAGE IS
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DENVER FITZSIMMONS
GRID 1
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	1	0	2	3	2	.67	.25
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	1	0	2	3	1	.33	.40
TOTALS		2	0	4	6	3		
COMMISSIONS		1	0	2	3			
		.50	0.00	.50				

OVERALL CLASSIFICATION ACCURACY .50 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY .35 P(BETA ERROR) = .33

DENVER FITZSIMMONS
GRID 2
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	1	0	1	0	0.00	.50
E	OTHER (O)	0	1	4	5	1	.20	.80
TOTALS		0	2	4	6	1		
COMMISSIONS		0	1	0	1			
		0.00	.50	0.00				

OVERALL CLASSIFICATION ACCURACY .83 P(ALPHA ERROR)= .17

OVERALL MAPPING ACCURACY .70 P(BETA ERROR) = .07

DENVER FITZSIMMONS
GRID 3
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

MAPPED AS

	CLASS	R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	2	1	3	1	.33	.67
E	OTHER (O)	0	0	3	3	0	0.00	.75
	TOTALS	0	2	4	6	1		
	COMISSIONS	0	0	1	1			
		0.00	0.00	.25				

OVERALL CLASSIFICATION ACCURACY .83 P(ALPHA ERROR)= .08

OVERALL MAPPING ACCURACY .72 P(BETA ERROR) = .11

DENVER FITZSIMMONS
GRID 4
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

MAPPED AS

	CLASS	R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	1	0	4	5	4	.80	.20
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	0	1	1	0	0.00	.20
	TOTALS	1	0	5	6	4		
	COMISSIONS	0	0	4	4			
		0.00	0.00	.80				

OVERALL CLASSIFICATION ACCURACY .33 P(ALPHA ERROR)= .27

OVERALL MAPPING ACCURACY .20 P(BETA ERROR) = .27

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DENVER FITZSIMMONS
GRID 5
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

T R U E	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
	OTHER (O)	0	0	6	6	0	0.00	1.00
	TOTALS	0	0	6	6	0		
	COMISSIONS	0	0	0	0			
		0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 1.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 1.00 P(BETA ERROR) = 0.00

DENVER FITZSIMMONS
GRID 6
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

T R U E	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
	AGRICULTURE (A)	0	1	0	1	0	0.00	1.00
	OTHER (O)	1	0	1	2	1	.50	.50
	TOTALS	1	1	1	3	1		
	COMISSIONS	1	0	0	1			
		1.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY .67 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY .50 P(BETA ERROR) = .17

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DENVER FITZSIMMONS
GRID 7
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS	R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
		MAPPED AS						
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	1	2	3	1	.33	.67
TOTALS		0	1	2	3	1		
COMISSIONS		0	1	0	1			
		0.00	1.00	0.00				

OVERALL CLASSIFICATION ACCURACY .67

OVERALL MAPPING ACCURACY .44

P(ALPHA ERROR)= .33

P(BETA ERROR) = .11

DENVER FITZSIMMONS
GRID 8
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS	R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
		MAPPED AS						
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	0	2	2	0	0.00	1.00
TOTALS		0	0	2	2	0		
COMISSIONS		0	0	0	0			
		0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 1.00

OVERALL MAPPING ACCURACY 1.00

P(ALPHA ERROR)= 0.00

P(BETA ERROR) = 0.00

DENVER FITZSIMMONS
GRID 9
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS		MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	0	0	1	1	0	0.00	1.00
TOTALS			0	0	1	1	0		
COMISSIONS			0	0	0	0			
			0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 1.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 1.00 P(BETA ERROR) = 0.00

RICHMOND SEVEN PINES
GRID 1
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T R	RESIDENTIAL (R)	0	0	2	2	2	1.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	1	1	2	1	.50	.25
	TOTALS	0	1	3	4	3		
	COMISSIONS	0	1	2	3			
		0.00	1.00	.67				

OVERALL CLASSIFICATION ACCURACY .25 P(ALPHA ERROR)= .56

OVERALL MAPPING ACCURACY .19 P(BETA ERROR) = .50

RICHMOND SEVEN PINES
GRID 2
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T R	RESIDENTIAL (R)	0	0	1	1	1	1.00	0.00
U	AGRICULTURE (A)	0	0	1	1	1	1.00	0.00
E	OTHER (O)	0	0	0	0	0	0.00	0.00
	TOTALS	0	0	2	2	2		
	COMISSIONS	0	0	2	2			
		0.00	0.00	1.00				

OVERALL CLASSIFICATION ACCURACY 0.00 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY 0.00 P(BETA ERROR) = .67

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RICHMOND SEVEN PINES
GRID 3
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS		R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
			MAPPED AS						
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	0	1	1	1	1.00	0.00
E	OTHER	(O)	0	0	1	1	0	0.00	.50
	TOTALS		0	0	2	2	1		
	COMISSIONS		0	0	1	1			
			0.00	0.00	.50				

OVERALL CLASSIFICATION ACCURACY .50 P(ALPHA ERROR)= .17

OVERALL MAPPING ACCURACY .50 P(BETA ERROR) = .33

RICHMOND SEVEN PINES
GRID 4
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS		R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
			MAPPED AS						
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	1	0	0	1	1	1.00	0.00
E	OTHER	(O)	1	0	1	2	1	.50	.50
	TOTALS		2	0	1	3	2		
	COMISSIONS		2	0	0	2			
			1.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY .33 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY .17 P(BETA ERROR) = .50

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RICHMOND SEVEN PINES
GRID 5
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	1	1	1	1.00	0.00
E	OTHER (O)	1	0	0	1	1	1.00	0.00
	TOTALS	1	0	1	2	2		
	COMISSIONS	1	0	1	2			
		1.00	0.00	1.00				

OVERALL CLASSIFICATION ACCURACY 0.00 P(ALPHA ERROR)= .67

OVERALL MAPPING ACCURACY 0.00 P(BETA ERROR) = .67

RICHMOND SEVEN PINES
GRID 6
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	1	0	0	1	0	0.00	1.00
U	AGRICULTURE (A)	0	0	1	1	1	1.00	0.00
E	OTHER (O)	0	0	1	1	0	0.00	.50
	TOTALS	1	0	2	3	1		
	COMISSIONS	0	0	1	1			
		0.00	0.00	.50				

OVERALL CLASSIFICATION ACCURACY .67 P(ALPHA ERROR)= .17

OVERALL MAPPING ACCURACY .67 P(BETA ERROR) = .33

RICHMOND SEVEN PINES
GRID 7
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS		MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	1	0	0	1	1	1.00	0.00
E	OTHER	(O)	1	0	0	1	1	1.00	0.00
TOTALS			2	0	0	2	2		
COMISSIONS			2	0	0	2			
			1.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 0.00 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY 0.00 P(BETA ERROR) = .67

RICHMOND SEVEN PINES
GRID 8
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS		MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	0	1	1	1	1.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	0	0	0	0	0	0.00	0.00
TOTALS			0	0	1	1	1		
COMISSIONS			0	0	1	1			
			0.00	0.00	1.00				

OVERALL CLASSIFICATION ACCURACY 0.00 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY 0.00 P(BETA ERROR) = .33

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RICHMOND SEVEN PINES
GRID 9
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

MAPPED AS

	CLASS	R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	0	3	3	0	0.00	1.00
TOTALS		0	0	3	3	0		
COMISSIONS		0	0	0	0			
		0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 1.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 1.00 P(BETA ERROR) = 0.00

RICHMOND SEVEN PINES
GRID 10
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

MAPPED AS

	CLASS	R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	1	0	1	2	2	1.00	0.00
E	OTHER (O)	0	0	1	1	0	0.00	.50
TOTALS		1	0	2	3	2		
COMISSIONS		1	0	1	2			
		1.00	0.00	.50				

OVERALL CLASSIFICATION ACCURACY .33 P(ALPHA ERROR)= .50

OVERALL MAPPING ACCURACY .33 P(BETA ERROR) = .33

RICHMOND SEVEN PINES
GRID 11
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS		MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	2	0	1	3	2	.67	.33
TOTALS			2	0	1	3	2		
COMISSIONS			2	0	0	2			
			1.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY .33 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY .11 P(BETA ERROR) = .22

RICHMOND SEVEN PINES
GRID 12
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS		MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	0	0	2	2	0	0.00	1.00
TOTALS			0	0	2	2	0		
COMISSIONS			0	0	0	0			
			0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 1.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 1.00 P(BETA ERROR) = 0.00

RICHMOND CHESTERFIELD
GRID 1
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS		MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	0	0	2	2	0	0.00	1.00
	TOTALS		0	0	2	2	0		
	COMISSIONS		0	0	0	0			
			0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY	1.00	P(ALPHA ERROR)=	0.00
OVERALL MAPPING ACCURACY	1.00	P(BETA ERROR) =	0.00

RICHMOND CHESTERFIELD
GRID 2
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS		MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	1	0	1	2	1	.50	.50
	TOTALS		1	0	1	2	1		
	COMISSIONS		1	0	0	1			
			1.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY	.50	P(ALPHA ERROR)=	.33
OVERALL MAPPING ACCURACY	.25	P(BETA ERROR) =	.17

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RICHMOND CHESTERFIELD
GRID 3
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS		MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	1	0	0	1	1	1.00	0.00
TOTALS			1	0	0	1	1		
COMISSIONS			1	0	0	1			
			1.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 0.00 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY 0.00 P(BETA ERROR) = .33

RICHMOND CHESTERFIELD
GRID 4
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS		MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	0	0	3	3	0	0.00	1.00
TOTALS			0	0	3	3	0		
COMISSIONS			0	0	0	0			
			0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 1.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 1.00 P(BETA ERROR) = 0.00

RICHMOND CHESTERFIELD
GRID 5
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS		MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	0	0	2	2	0	0.00	1.00
TOTALS			0	0	2	2	0		
COMISSIONS			0	0	0	0			
			0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 1.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 1.00 P(BETA ERROR) = 0.00

RICHMOND CHESTERFIELD
GRID 6
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS		MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	0	0	2	2	0	0.00	1.00
TOTALS			0	0	2	2	0		
COMISSIONS			0	0	0	0			
			0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 1.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 1.00 P(BETA ERROR) = 0.00

RICHMOND CHESTERFIELD
GRID 7
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	0	2	2	0	0.00	1.00
	TOTALS	0	0	2	2	0		
	COMISSIONS	0	0	0	0			
		0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 1.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 1.00 P(BETA ERROR) = 0.00

RICHMOND CHESTERFIELD
GRID 8
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	0	2	2	0	0.00	1.00
	TOTALS	0	0	2	2	0		
	COMISSIONS	0	0	0	0			
		0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 1.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 1.00 P(BETA ERROR) = 0.00

RICHMOND CHESTERFIELD
GRID 9
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

		MAPPED AS						
	CLASS	R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	0	0	0	0	0.00	0.00
	TOTALS	0	0	0	0	0		
	COMISSIONS	0	0	0	0			
		0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 0.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 0.00 P(BETA ERROR) = 0.00

RICHMOND CHESTERFIELD
GRID 10
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

		MAPPED AS						
	CLASS	R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	0	0	0	0	0.00	0.00
	TOTALS	0	0	0	0	0		
	COMISSIONS	0	0	0	0			
		0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 0.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 0.00 P(BETA ERROR) = 0.00

RICHMOND CHESTERFIELD
GRID 11
TEST TYPE: BLOCK COORDINATE

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CONFUSION TABLE

	CLASS		MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	0	0	0	0	0	0.00	0.00
TOTALS			0	0	0	0	0		
COMISSIONS			0	0	0	0			
			0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 0.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 0.00 P(BETA ERROR) = 0.00

RICHMOND CHESTERFIELD
GRID 12
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS		MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	0	0	0	0	0	0.00	0.00
TOTALS			0	0	0	0	0		
COMISSIONS			0	0	0	0			
			0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 0.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 0.00 P(BETA ERROR) = 0.00

PHASE ONE - DIFFUSE

DENVER FITZSIMMONS
GRID 1
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
RESIDENTIAL (R)	3	0	0	3	0	0.00	.75
AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
OTHER (O)	1	0	2	3	1	.33	.67
TOTALS	4	0	2	6	1		
COMISSIONS	1	0	0	1			
	.25	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY .83 P(ALPHA ERROR)= .08

OVERALL MAPPING ACCURACY .72 P(BETA ERROR) = .11

DENVER FITZSIMMONS
GRID 2
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
AGRICULTURE (A)	0	0	1	1	1	1.00	0.00
OTHER (O)	2	0	3	5	2	.40	.50
TOTALS	2	0	4	6	3		
COMISSIONS	2	0	1	3			
	1.00	0.00	.25				

OVERALL CLASSIFICATION ACCURACY .50 P(ALPHA ERROR)= .42

OVERALL MAPPING ACCURACY .33 P(BETA ERROR) = .47

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DENVER FITZSIMMONS
GRID 3
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
AGRICULTURE (A)	0	1	2	3	2	.67	.25
OTHER (O)	1	1	1	3	2	.67	.20
TOTALS	1	2	3	6	4		
COMISSIONS	1	1	2	4			
	1.00	.50	.67				

OVERALL CLASSIFICATION ACCURACY .33 P(ALPHA ERROR)= .72

OVERALL MAPPING ACCURACY .18 P(BETA ERROR) = .44

DENVER FITZSIMMONS
GRID 4
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
RESIDENTIAL (R)	5	0	0	5	0	0.00	1.00
AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
OTHER (O)	0	0	1	1	0	0.00	1.00
TOTALS	5	0	1	6	0		
COMISSIONS	0	0	0	0			
	0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 1.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 1.00 P(BETA ERROR) = 0.00

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DENVER FITZSIMMONS
GRID 5
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS		MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	0	2	4	6	2	.33	.67
	TOTALS		0	2	4	6	2		
	COMISSIONS		0	2	0	2			
			0.00	1.00	0.00				

OVERALL CLASSIFICATION ACCURACY .67 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY .44 P(BETA ERROR) = .11

DENVER FITZSIMMONS
GRID 6
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS		MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	1	0	0	1	1	1.00	0.00
E	OTHER	(O)	0	0	2	2	0	0.00	1.00
	TOTALS		1	0	2	3	1		
	COMISSIONS		1	0	0	1			
			1.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY .67 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY .67 P(BETA ERROR) = .33

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DENVER FITZSIMMONS
GRID 7
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS		MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	1	0	2	3	1	.33	.67
	TOTALS		1	0	2	3	1		
	COMMISSIONS		1	0	0	1			
			1.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY .67 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY .44 P(BETA ERROR) = .11

DENVER FITZSIMMONS
GRID 8
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS		MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	0	0	2	2	0	0.00	1.00
	TOTALS		0	0	2	2	0		
	COMMISSIONS		0	0	0	0			
			0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 1.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 1.00 P(BETA ERROR) = 0.00

DENVER FITZSIMMONS
GRID 9
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS		MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	0	0	1	1	0	0.00	1.00
TOTALS			0	0	1	1	0		
COMISSIONS			0	0	0	0			
			0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 1.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 1.00 P(BETA ERROR) = 0.00

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RICHMOND SEVEN PINES
GRID 1
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS		MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	0	2	2	2	1.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	0	1	1	2	1	.50	.25
TOTALS			0	1	3	4	3		
COMISSIONS			0	1	2	3			
			0.00	1.00	.67				

OVERALL CLASSIFICATION ACCURACY .25 P(ALPHA ERROR)= .56

OVERALL MAPPING ACCURACY .19 P(BETA ERROR) = .50

RICHMOND SEVEN PINES
GRID 2
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS		MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	0	1	1	1	1.00	0.00
U	AGRICULTURE	(A)	0	0	1	1	1	1.00	0.00
E	OTHER	(O)	0	0	0	0	0	0.00	0.00
TOTALS			0	0	2	2	2		
COMISSIONS			0	0	2	2			
			0.00	0.00	1.00				

OVERALL CLASSIFICATION ACCURACY 0.00 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY 0.00 P(BETA ERROR) = .67

RICHMOND SEVEN PINES
GRID 3
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS	R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
		MAPPED AS						
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	1	0	1	0	0.00	.50
E	OTHER (O)	0	1	0	1	1	1.00	0.00
	TOTALS	0	2	0	2	1		
	COMISSIONS	0	1	0	1			
		0.00	.50	0.00				

OVERALL CLASSIFICATION ACCURACY .50 P(ALPHA ERROR)= .17

OVERALL MAPPING ACCURACY .50 P(BETA ERROR) = .33

RICHMOND SEVEN PINES
GRID 4
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS	R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
		MAPPED AS						
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	1	1	1	1.00	0.00
E	OTHER (O)	0	0	2	2	0	0.00	.67
	TOTALS	0	0	3	3	1		
	COMISSIONS	0	0	1	1			
		0.00	0.00	.33				

OVERALL CLASSIFICATION ACCURACY .67 P(ALPHA ERROR)= .11

OVERALL MAPPING ACCURACY .67 P(BETA ERROR) = .33

RICHMOND SEVEN PINES
GRID 5
TEST TYPE: DIFFUSE COORDINATE

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CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	1	1	1	1.00	0.00
E	OTHER (O)	0	0	1	1	0	0.00	.50
TOTALS		0	0	2	2	1		
COMISSIONS		0	0	1	1			
		0.00	0.00	.50				

OVERALL CLASSIFICATION ACCURACY .50 P(ALPHA ERROR)= .17

OVERALL MAPPING ACCURACY .50 P(BETA ERROR) = .33

RICHMOND SEVEN PINES
GRID 6
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	1	1	1	1.00	0.00
U	AGRICULTURE (A)	0	0	1	1	1	1.00	0.00
E	OTHER (O)	0	0	1	1	0	0.00	.33
TOTALS		0	0	3	3	2		
COMISSIONS		0	0	2	2			
		0.00	0.00	.67				

OVERALL CLASSIFICATION ACCURACY .33 P(ALPHA ERROR)= .22

OVERALL MAPPING ACCURACY .33 P(BETA ERROR) = .67

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RICHMOND SEVEN PINES
GRID 7
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS		MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	0	1	1	1	1.00	0.00
E	OTHER	(O)	0	0	1	1	0	0.00	.50
TOTALS			0	0	2	2	1		
COMISSIONS			0	0	1	1			
			0.00	0.00	.50				

OVERALL CLASSIFICATION ACCURACY .50 P(ALPHA ERROR)= .17

OVERALL MAPPING ACCURACY .50 P(BETA ERROR) = .33

RICHMOND SEVEN PINES
GRID 8
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS		MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	0	1	1	1	1.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	0	0	0	0	0	0.00	0.00
TOTALS			0	0	1	1	1		
COMISSIONS			0	0	1	1			
			0.00	0.00	1.00				

OVERALL CLASSIFICATION ACCURACY 0.00 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY 0.00 P(BETA ERROR) = .33

RICHMOND SEVEN PINES
GRID 9
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	2	1	3	2	.67	.33
	TOTALS	0	2	1	3	2		
	COMISSIONS	0	2	0	2			
		0.00	1.00	0.00				

OVERALL CLASSIFICATION ACCURACY .33 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY .11 P(BETA ERROR) = .22

RICHMOND SEVEN PINES
GRID 10
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	1	1	2	1	.50	.50
E	OTHER (O)	0	0	1	1	0	0.00	.50
	TOTALS	0	1	2	3	1		
	COMISSIONS	0	0	1	1			
		0.00	0.00	.50				

OVERALL CLASSIFICATION ACCURACY .67 P(ALPHA ERROR)= .17

OVERALL MAPPING ACCURACY .50 P(BETA ERROR) = .17

RICHMOND SEVEN PINES
GRID 11
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	0	3	3	0	0.00	1.00
TOTALS		0	0	3	3	0		
COMISSIONS		0	0	0	0			
		0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 1.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 1.00 P(BETA ERROR) = 0.00

RICHMOND SEVEN PINES
GRID 12
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	0	2	2	0	0.00	1.00
TOTALS		0	0	2	2	0		
COMISSIONS		0	0	0	0			
		0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 1.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 1.00 P(BETA ERROR) = 0.00

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RICHMOND CHESTERFIELD
GRID 1
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS		MAPPED AS R	MAPPED AS A	MAPPED AS O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	0	1	1	2	1	.50	.50
	TOTALS		0	1	1	2	1		
	COMISSIONS		0	1	0	1			
			0.00	1.00	0.00				

OVERALL CLASSIFICATION ACCURACY .50 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY .25 P(BETA ERROR) = .17

RICHMOND CHESTERFIELD
GRID 2
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS		MAPPED AS R	MAPPED AS A	MAPPED AS O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	0	0	2	2	0	0.00	1.00
	TOTALS		0	0	2	2	0		
	COMISSIONS		0	0	0	0			
			0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 1.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 1.00 P(BETA ERROR) = 0.00

RICHMOND CHESTERFIELD
GRID 3
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS		MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	0	0	1	1	0	0.00	1.00
TOTALS			0	0	1	1	0		
COMISSIONS			0	0	0	0			
			0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 1.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 1.00 P(BETA ERROR) = 0.00

RICHMOND CHESTERFIELD
GRID 4
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS		MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	0	2	1	3	2	.67	.33
TOTALS			0	2	1	3	2		
COMISSIONS			0	2	0	2			
			0.00	1.00	0.00				

OVERALL CLASSIFICATION ACCURACY .33 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY .11 P(BETA ERROR) = .22

RICHMOND CHESTERFIELD
GRID 5
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS	R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
		MAPPED AS						
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	0	2	2	0	0.00	1.00
TOTALS		0	0	2	2	0		
COMISSIONS		0	0	0	0			
		0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 1.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 1.00 P(BETA ERROR) = 0.00

RICHMOND CHESTERFIELD
GRID 6
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS	R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
		MAPPED AS						
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	0	2	2	0	0.00	1.00
TOTALS		0	0	2	2	0		
COMISSIONS		0	0	0	0			
		0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 1.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 1.00 P(BETA ERROR) = 0.00

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RICHMOND CHESTERFIELD
GRID 7
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	1	1	2	1	.50	.50
	TOTALS	0	1	1	2	1		
	COMISSIONS	0	1	0	1			
		0.00	1.00	0.00				

OVERALL CLASSIFICATION ACCURACY .50 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY .25 P(BETA ERROR) = .17

RICHMOND CHESTERFIELD
GRID 8
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	1	1	2	1	.50	.50
	TOTALS	0	1	1	2	1		
	COMISSIONS	0	1	0	1			
		0.00	1.00	0.00				

OVERALL CLASSIFICATION ACCURACY .50 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY .25 P(BETA ERROR) = .17

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RICHMOND CHESTERFIELD
GRID 9
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS		R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
			MAPPED AS						
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	0	0	0	0	0	0.00	0.00
TOTALS			0	0	0	0	0		
COMISSIONS			0	0	0	0			
			0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 0.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 0.00 P(BETA ERROR) = 0.00

RICHMOND CHESTERFIELD
GRID 10
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS		R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIE
			MAPPED AS						
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	0	0	0	0	0	0.00	0.00
TOTALS			0	0	0	0	0		
COMISSIONS			0	0	0	0			
			0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 0.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 0.00 P(BETA ERROR) = 0.00

RICHMOND CHESTERFIELD
GRID 11
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T R RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E OTHER (O)	0	0	0	0	0	0.00	0.00
TOTALS	0	0	0	0	0		
COMISSIONS	0	0	0	0			
	0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 0.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 0.00 P(BETA ERROR) = 0.00

RICHMOND CHESTERFIELD
GRID 12
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T R RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E OTHER (O)	0	0	0	0	0	0.00	0.00
TOTALS	0	0	0	0	0		
COMISSIONS	0	0	0	0			
	0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 0.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 0.00 P(BETA ERROR) = 0.00

PHASE TWO - BLOCKED

PHASE II, DENVER HIGHLAND RANCH
GRID 1
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	1	4	5	1	.20	.80
	TOTALS	0	1	4	5	1		
	COMMISSIONS	0	1	0	1			
		0.00	1.00	0.00				

OVERALL CLASSIFICATION ACCURACY .80 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY .64 P(BETA ERROR) = .07

PHASE II, DENVER HIGHLAND RANCH
GRID 2
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	1	0	2	3	2	.67	.33
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	1	3	4	1	.25	.50
	TOTALS	1	1	5	7	3		
	COMMISSIONS	0	1	2	3			
		0.00	1.00	.40				

OVERALL CLASSIFICATION ACCURACY .57 P(ALPHA ERROR)= .47

OVERALL MAPPING ACCURACY .40 P(BETA ERROR) = .31

PHASE II, DENVER HIGHLAND RANCH
GRID 3
TEST TYPE: BLOCK COORDINATE

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CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	1	6	7	1	.14	.86
	TOTALS	0	1	6	7	1		
	COMMISSIONS	0	1	0	1			
		0.00	1.00	0.00				

OVERALL CLASSIFICATION ACCURACY .86 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY .73 P(BETA ERROR) = .05

PHASE II, DENVER HIGHLAND RANCH
GRID 4
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	6	6	6	1.00	0.00
E	OTHER (O)	0	0	2	2	0	0.00	.25
	TOTALS	0	0	8	8	6		
	COMMISSIONS	0	0	6	6			
		0.00	0.00	.75				

OVERALL CLASSIFICATION ACCURACY .25 P(ALPHA ERROR)= .25

OVERALL MAPPING ACCURACY .25 P(BETA ERROR) = .33

PHASE II, DENVER HIGHLAND RANCH
GRID 5
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS	R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	5	5	5	1.00	0.00
E	OTHER (O)	0	0	1	1	0	0.00	.17
	TOTALS	0	0	6	6	5		
	COMMISSIONS	0	0	5	5			
		0.00	0.00	.83				

(R, A, O: MAPPED AS)

OVERALL CLASSIFICATION ACCURACY .17 P(ALPHA ERROR)= .28

OVERALL MAPPING ACCURACY .17 P(BETA ERROR) = .33

PHASE II, DENVER HIGHLAND RANCH
GRID 6
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS	R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	2	4	6	4	.67	.33
E	OTHER (O)	1	0	0	1	1	1.00	0.00
	TOTALS	1	2	4	7	5		
	COMMISSIONS	1	0	4	5			
		1.00	0.00	1.00				

(R, A, O: MAPPED AS)

OVERALL CLASSIFICATION ACCURACY .29 P(ALPHA ERROR)= .67

OVERALL MAPPING ACCURACY .10 P(BETA ERROR) = .56

PHASE II, DENVER HIGHLAND RANCH
GRID 7
TEST TYPE: BLOCK COORDINATE

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CONFUSION TABLE

	CLASS		MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	5	0	3	6	5	.63	.38
	TOTALS		5	0	3	8	5		
	COMMISSIONS		5	0	0	5			
			1.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY .38 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY .14 P(BETA ERROR) = .21

PHASE II, DENVER HIGHLAND RANCH
GRID 8
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS		MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	1	0	6	7	1	.14	.86
	TOTALS		1	0	6	7	1		
	COMMISSIONS		1	0	0	1			
			1.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY .86 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY .73 P(BETA ERROR) = .05

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PHASE II, DENVER HIGHLAND RANCH
GRID 9
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	2	1	3	1	.33	.50
E	OTHER (O)	0	1	3	4	1	.25	.60
	TOTALS	0	3	4	7	2		
	COMMISSIONS	0	1	1	2			
		0.00	.33	.25				

OVERALL CLASSIFICATION ACCURACY .71 P(ALPHA ERROR)= .19

OVERALL MAPPING ACCURACY .56 P(BETA ERROR) = .19

PHASE II, DENVER SABLE
GRID 1
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	3	0	4	7	3	.43	.57
TOTALS		3	0	4	7	3		
COMMISSIONS		3	0	0	3			
		1.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY .57 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY .33 P(BETA ERROR) = .14

PHASE II, DENVER SABLE
GRID 2
TEST TYPE: BLOCK COORDINATE

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CONFUSION TABLE

	CLASS		R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
			MAPPED AS						
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	3	0	5	8	3	.38	.63
	TOTALS		3	0	5	8	3		
	COMMISSIONS		3	0	0	3			
			1.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY .63 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY .39 P(BETA ERROR) = .13

PHASE II, DENVER SABLE
GRID 3
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS		R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
			MAPPED AS						
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	0	1	1	1	1.00	0.00
E	OTHER	(O)	1	0	4	5	1	.20	.67
	TOTALS		1	0	5	6	2		
	COMMISSIONS		1	0	1	2			
			1.00	0.00	.20				

OVERALL CLASSIFICATION ACCURACY .67 P(ALPHA ERROR)= .40

OVERALL MAPPING ACCURACY .56 P(BETA ERROR) = .40

PHASE II, DENVER SABLE
GRID 4
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS	R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
		MAPPED AS						
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	0	7	7	0	0.00	1.00
	TOTALS	0	0	7	7	0		
	COMMISSIONS	0	0	0	0			
		0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 1.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 1.00 P(BETA ERROR) = 0.00

PHASE II, DENVER SABLE
GRID 5
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS	R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
		MAPPED AS						
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	7	7	7	1.00	0.00
E	OTHER (O)	0	0	1	1	0	0.00	.13
	TOTALS	0	0	8	8	7		
	COMMISSIONS	0	0	7	7			
		0.00	0.00	.88				

OVERALL CLASSIFICATION ACCURACY .13 P(ALPHA ERROR)= .29

OVERALL MAPPING ACCURACY .13 P(BETA ERROR) = .33

PHASE II, DENVER SABLE
GRID 6
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

		MAPPED AS						
	CLASS	R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	1	3	4	4	1.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	2	2	4	2	.50	.29
TOTALS		0	3	5	8	6		
COMMISSIONS		0	3	3	6			
		0.00	1.00	.60				

OVERALL CLASSIFICATION ACCURACY .25 P(ALPHA ERROR)= .53

OVERALL MAPPING ACCURACY .18 P(BETA ERROR) = .50

PHASE II, DENVER SABLE
GRID 7
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

		MAPPED AS						
	CLASS	R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	2	0	2	0	0.00	1.00
E	OTHER (O)	1	0	3	4	1	.25	.75
TOTALS		1	2	3	6	1		
COMMISSIONS		1	0	0	1			
		1.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY .83 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY .71 P(BETA ERROR) = .08

PHASE II, DENVER SABLE
GRID 8
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	3	3	3	1.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	0	3	3	0	0.00	.50
	TOTALS	0	0	6	6	3		
	COMMISSIONS	0	0	3	3			
		0.00	0.00	.50				

OVERALL CLASSIFICATION ACCURACY .50 P(ALPHA ERROR)= .17

OVERALL MAPPING ACCURACY .50 P(BETA ERROR) = .33

PHASE II, DENVER EAST LAKE
GRID 1
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS		R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
			MAPPED AS						
T									
R	RESIDENTIAL	(R)	0	1	5	6	6	1.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	0	0	1	1	0	0.00	.17
TOTALS			0	1	6	7	6		
COMMISSIONS			0	1	5	6			
			0.00	1.00	.83				

OVERALL CLASSIFICATION ACCURACY .14 P(ALPHA ERROR)= .61

OVERALL MAPPING ACCURACY .14 P(BETA ERROR) = .33

PHASE II, DENVER EAST LAKE
GRID 2
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS		R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
			MAPPED AS						
T									
R	RESIDENTIAL	(R)	2	0	3	5	3	.60	.40
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	0	0	2	2	0	0.00	.40
TOTALS			2	0	5	7	3		
COMMISSIONS			0	0	3	3			
			0.00	0.00	.60				

OVERALL CLASSIFICATION ACCURACY .57 P(ALPHA ERROR)= .20

OVERALL MAPPING ACCURACY .40 P(BETA ERROR) = .20

PHASE II, DENVER EAST LAKE
GRID 3
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

		MAPPED AS						
	CLASS	R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	4	4	4	1.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	1	0	1	1	1.00	0.00
TOTALS		0	1	4	5	5		
COMMISSIONS		0	1	4	5			
		0.00	1.00	1.00				

OVERALL CLASSIFICATION ACCURACY 0.00 P(ALPHA ERROR)= .67

OVERALL MAPPING ACCURACY 0.00 P(BETA ERROR) = .67

PHASE II, DENVER EAST LAKE
GRID 4
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

		MAPPED AS						
	CLASS	R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	1	0	0	1	1	1.00	0.00
TOTALS		1	0	0	1	1		
COMMISSIONS		1	0	0	1			
		1.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 0.00 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY 0.00 P(BETA ERROR) = .33

PHASE II, DENVER EAST LAKE
GRID 5
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	1	1	1	1.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	1	1	1	3	2	.67	.25
	TOTALS	1	1	2	4	3		
	COMMISSIONS	1	1	1	3			
		1.00	1.00	.50				

OVERALL CLASSIFICATION ACCURACY .25 P(ALPHA ERROR)= .83

OVERALL MAPPING ACCURACY .13 P(BETA ERROR) = .56

PHASE II, DENVER EAST LAKE
GRID 6
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	1	5	6	1	.17	.83
	TOTALS	0	1	5	6	1		
	COMMISSIONS	0	1	0	1			
		0.00	1.00	0.00				

OVERALL CLASSIFICATION ACCURACY .83 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY .69 P(BETA ERROR) = .05

PHASE II, DENVER LITTLETON
GRID 1
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS	R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	0	1	1	0	0.00	1.00
TOTALS		0	0	1	1	0		
COMMISSIONS		0	0	0	0			
		0.00	0.00	0.00				

(R, A, O columns: MAPPED AS)

OVERALL CLASSIFICATION ACCURACY 1.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 1.00 P(BETA ERROR) = 0.00

PHASE II, DENVER LITTLETON
GRID 2
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS	R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	3	3	3	1.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	0	2	2	0	0.00	.40
TOTALS		0	0	5	5	3		
COMMISSIONS		0	0	3	3			
		0.00	0.00	.60				

(R, A, O columns: MAPPED AS)

OVERALL CLASSIFICATION ACCURACY .40 P(ALPHA ERROR)= .20

OVERALL MAPPING ACCURACY .40 P(BETA ERROR) = .33

PHASE II, DENVER LITTLETON
GRID 3
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	MAPPED AS A	MAPPED AS O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	0	1	1	0	0.00	1.00
	TOTALS	0	0	1	1	0		
	COMMISSIONS	0	0	0	0			
		0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 1.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 1.00 P(BETA ERROR) = 0.00

PHASE II, DENVER LITTLETON
GRID 6
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	MAPPED AS A	MAPPED AS O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	0	2	2	0	0.00	1.00
	TOTALS	0	0	2	2	0		
	COMMISSIONS	0	0	0	0			
		0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 1.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 1.00 P(BETA ERROR) = 0.00

PHASE II, DENVER LITTLETON
GRID 8
TEST TYPE: BLOCK COORDINATE

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CONFUSION TABLE

	CLASS	R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
		MAPPED AS						
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	0	1	1	0	0.00	1.00
	TOTALS	0	0	1	1	0		
	COMMISSIONS	0	0	0	0			
		0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 1.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 1.00 P(BETA ERROR) = 0.00

PHASE II, DENVER LITTLETON
GRID 9
TEST TYPE: BLOCK COORDINATE

CONFUSION TABLE

	CLASS	R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
		MAPPED AS						
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	1	0	1	2	1	.50	.50
	TOTALS	1	0	1	2	1		
	COMMISSIONS	1	0	0	1			
		1.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY .50 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY .25 P(BETA ERROR) = .17

PHASE TWO - DIFFUSE

C-5

PHASE II, DENVER HIGHLAND RANCH
GRID 1
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS		R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	0	2	4	6	2	.33	.67
TOTALS			0	2	4	6	2		
COMMISSIONS			0	2	0	2			
			0.00	1.00	0.00				

(R, A, O: MAPPED AS)

OVERALL CLASSIFICATION ACCURACY .67 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY .44 P(BETA ERROR) = .11

PHASE II, DENVER HIGHLAND RANCH
GRID 2
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS		R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	2	2	4	4	1.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	0	1	2	3	1	.33	.40
TOTALS			0	3	4	7	5		
COMMISSIONS			0	3	2	5			
			0.00	1.00	.50				

(R, A, O: MAPPED AS)

OVERALL CLASSIFICATION ACCURACY .29 P(ALPHA ERROR)= .50

OVERALL MAPPING ACCURACY .23 P(BETA ERROR) = .44

PHASE II, DENVER HIGHLAND RANCH
GRID 3
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	1	6	7	1	.14	.86
	TOTALS	0	1	6	7	1		
	COMMISSIONS	0	1	0	1			
		0.00	1.00	0.00				

OVERALL CLASSIFICATION ACCURACY .86 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY .73 P(BETA ERROR) = .05

PHASE II, DENVER HIGHLAND RANCH
GRID 4
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	4	0	4	0	0.00	1.00
E	OTHER (O)	0	0	3	3	0	0.00	1.00
	TOTALS	0	4	3	7	0		
	COMMISSIONS	0	0	0	0			
		0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 1.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 1.00 P(BETA ERROR) = 0.00

PHASE II, DENVER HIGHLAND RANCH
GRID 5
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS		R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
			MAPPED AS						
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	3	2	5	2	.40	.50
E	OTHER	(O)	1	1	0	2	2	1.00	0.00
TOTALS			1	4	2	7	4		
COMMISSIONS			1	1	2	4			
			1.00	.25	1.00				

OVERALL CLASSIFICATION ACCURACY .43 P(ALPHA ERROR)= .75

OVERALL MAPPING ACCURACY .29 P(BETA ERROR) = .47

PHASE II, DENVER HIGHLAND RANCH
GRID 6
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS		R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
			MAPPED AS						
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	4	2	6	2	.33	.67
E	OTHER	(O)	0	0	1	1	0	0.00	.33
TOTALS			0	4	3	7	2		
COMMISSIONS			0	0	2	2			
			0.00	0.00	.67				

OVERALL CLASSIFICATION ACCURACY .71 P(ALPHA ERROR)= .22

OVERALL MAPPING ACCURACY .52 P(BETA ERROR) = .11

PHASE II, DENVER HIGHLAND RANCH
GRID 7
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS	R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
		MAPPED AS						
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	3	1	4	8	4	.50	.50
	TOTALS	3	1	4	8	4		
	COMMISSIONS	3	1	0	4			
		1.00	1.00	0.00				

OVERALL CLASSIFICATION ACCURACY .50 P(ALPHA ERROR)= .67

OVERALL MAPPING ACCURACY .25 P(BETA ERROR) = .17

PHASE II, DENVER HIGHLAND RANCH
GRID 8
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS	R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
		MAPPED AS						
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	1	3	4	8	4	.50	.50
	TOTALS	1	3	4	8	4		
	COMMISSIONS	1	3	0	4			
		1.00	1.00	0.00				

OVERALL CLASSIFICATION ACCURACY .50 P(ALPHA ERROR)= .67

OVERALL MAPPING ACCURACY .25 P(BETA ERROR) = .17

PHASE II, DENVER HIGHLAND RANCH
GRID 9
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS		MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	0	1	1	1	1.00	0.00
E	OTHER	(O)	0	2	4	6	2	.33	.57
TOTALS			0	2	5	7	3		
COMMISSIONS			0	2	1	3			
			0.00	1.00	.20				

OVERALL CLASSIFICATION ACCURACY .57 P(ALPHA ERROR)= .40

OVERALL MAPPING ACCURACY .41 P(BETA ERROR) = .44

PHASE II, DENVER SABLE
GRID 1
TEST TYPE: DIFFUSE COORDINATE

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CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	3	4	7	3	.43	.57
	TOTALS	0	3	4	7	3		
	COMMISSIONS	0	3	0	3			
		0.00	1.00	0.00				

OVERALL CLASSIFICATION ACCURACY .57 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY .33 P(BETA ERROR) = .14

PHASE II, DENVER SABLE
GRID 2
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	3	1	4	8	4	.50	.50
	TOTALS	3	1	4	8	4		
	COMMISSIONS	3	1	0	4			
		1.00	1.00	0.00				

OVERALL CLASSIFICATION ACCURACY .50 P(ALPHA ERROR)= .67

OVERALL MAPPING ACCURACY .25 P(BETA ERROR) = .17

PHASE II, DENVER SABLE
GRID 3
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS	R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
		MAPPED AS						
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	1	1	1	1.00	0.00
E	OTHER (O)	0	0	5	5	0	0.00	.83
	TOTALS	0	0	6	6	1		
	COMMISSIONS	0	0	1	1			
		0.00	0.00	.17				

OVERALL CLASSIFICATION ACCURACY .83 P(ALPHA ERROR)= .06

OVERALL MAPPING ACCURACY .83 P(BETA ERROR) = .33

PHASE II, DENVER SABLE
GRID 4
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS	R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
		MAPPED AS						
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	1	0	6	7	1	.14	.86
	TOTALS	1	0	6	7	1		
	COMMISSIONS	1	0	0	1			
		1.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY .86 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY .73 P(BETA ERROR) = .05

PHASE II, DENVER SABLE
GRID 6
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS		R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
			MAPPED AS						
T									
R	RESIDENTIAL	(R)	0	0	3	3	3	1.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	0	0	5	5	0	0.00	.63
	TOTALS		0	0	8	8	3		
	COMMISSIONS		0	0	3	3			
			0.00	0.00	.38				

OVERALL CLASSIFICATION ACCURACY .63 P(ALPHA ERROR)= .13

OVERALL MAPPING ACCURACY .63 P(BETA ERROR) = .22

PHASE II, DENVER SABLE
GRID 7
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS		R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
			MAPPED AS						
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	3	0	3	0	0.00	.75
E	OTHER	(O)	0	1	2	3	1	.33	.67
	TOTALS		0	4	2	6	1		
	COMMISSIONS		0	1	0	1			
			0.00	.25	0.00				

OVERALL CLASSIFICATION ACCURACY .83 P(ALPHA ERROR)= .08

OVERALL MAPPING ACCURACY .72 P(BETA ERROR) = .11

PHASE II, DENVER SABLE
GRID 8
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

T	CLASS		MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
R	RESIDENTIAL	(R)	0	1	2	3	3	1.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
F	OTHER	(O)	0	2	1	3	2	.67	.20
	TOTALS		0	3	3	6	5		
	COMMISSIONS		0	3	2	5			
			0.00	1.00	.67				

OVERALL CLASSIFICATION ACCURACY .17 P(ALPHA ERROR)= .56

OVERALL MAPPING ACCURACY .10 P(BETA ERROR) = .56

PHASE II, DENVER EAST LAKE
GRID 1
TEST TYPE: DIFFUSE COORDINATE

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CONFUSION TABLE

	CLASS	MAPPED AS R	MAPPED AS A	MAPPED AS O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	1	4	5	5	1.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	0	1	1	0	0.00	.20
	TOTALS	0	1	5	6	5		
	COMMISSIONS	0	1	4	5			
		0.00	1.00	.80				

OVERALL CLASSIFICATION ACCURACY .17 P(ALPHA ERROR)= .60

OVERALL MAPPING ACCURACY .17 P(BETA ERROR) = [illegible]

PHASE II, DENVER EAST LAKE
GRID 2
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	MAPPED AS A	MAPPED AS O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	1	1	4	6	5	.83	.17
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	0	1	1	0	0.00	.20
	TOTALS	1	1	5	7	5		
	COMMISSIONS	0	1	4	5			
		0.00	1.00	.80				

OVERALL CLASSIFICATION ACCURACY .29 P(ALPHA ERROR)= .60

OVERALL MAPPING ACCURACY .17 P(BETA ERROR) = .28

PHASE II, DENVER EAST LAKE
GRID 3
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS		R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
			MAPPED AS						
T									
R	RESIDENTIAL	(R)	0	0	2	2	2	1.00	0.00
U	AGRICULTURE	(A)	0	0	0	0	0	0.00	0.00
E	OTHER	(O)	0	0	2	2	0	0.00	.50
TOTALS			0	0	4	4	2		
COMMISSIONS			0	0	2	2			
			0.00	0.00	.50				

OVERALL CLASSIFICATION ACCURACY .50 P(ALPHA ERROR)= .17

OVERALL MAPPING ACCURACY .50 P(BETA ERROR) = .33

PHASE II, DENVER EAST LAKE
GRID 4
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS		R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
			MAPPED AS						
T									
R	RESIDENTIAL	(R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE	(A)	0	1	4	5	4	.80	.20
E	OTHER	(O)	0	0	0	0	0	0.00	0.00
TOTALS			0	1	4	5	4		
COMMISSIONS			0	0	4	4			
			0.00	0.00	1.00				

OVERALL CLASSIFICATION ACCURACY .20 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY .04 P(BETA ERROR) = .27

PHASE II, DENVER EAST LAKE
GRID 5
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	1	1	1	1.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	1	0	1	1	1.00	0.00
	TOTALS	0	1	1	2	2		
	COMMISSIONS	0	1	1	2			
		0.00	1.00	1.00				

OVERALL CLASSIFICATION ACCURACY 0.00 P(ALPHA ERROR)= .67

OVERALL MAPPING ACCURACY 0.00 P(BETA ERROR) = .67

PHASE II, DENVER EAST LAKE
GRID 6
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	1	2	2	5	3	.60	.40
	TOTALS	1	2	2	5	3		
	COMMISSIONS	1	2	0	3			
		1.00	1.00	0.00				

OVERALL CLASSIFICATION ACCURACY .40 P(ALPHA ERROR)= .67

OVERALL MAPPING ACCURACY .16 P(BETA ERROR) = .20

PHASE II, DENVER LITTLETON
GRID 1
TEST TYPE: DIFFUSE COORDINATE

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CONFUSION TABLE

MAPPED AS

	CLASS	R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	1	0	1	1	1.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	0	0	0	0	0.00	0.00
TOTALS		0	1	0	1	1		
COMMISSIONS		0	1	0	1			
		0.00	1.00	0.00				

OVERALL CLASSIFICATION ACCURACY 0.00 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY 0.00 P(BETA ERROR) = .33

PHASE II, DENVER LITTLETON
GRID 2
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

MAPPED AS

	CLASS	R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	2	1	3	3	1.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	0	2	2	0	0.00	.67
TOTALS		0	2	3	5	3		
COMMISSIONS		0	2	1	3			
		0.00	1.00	.33				

OVERALL CLASSIFICATION ACCURACY .40 P(ALPHA ERROR)= .44

OVERALL MAPPING ACCURACY .40 P(BETA ERROR) = .33

PHASE II, DENVER LITTLETON
GRID 3
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	0	1	1	0	0.00	1.00
	TOTALS	0	0	1	1	0		
	COMMISSIONS	0	0	0	0			
		0.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY 1.00 P(ALPHA ERROR)= 0.00

OVERALL MAPPING ACCURACY 1.00 P(BETA ERROR) = 0.00

PHASE II, DENVER LITTLETON
GRID 5
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

	CLASS	MAPPED AS R	A	O	TOTALS	OMISSIONS		MAPPING ACCURACIES
T								
R	RESIDENTIAL (R)	0	1	0	1	1	1.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	0	0	0	0	0.00	0.00
	TOTALS	0	1	0	1	1		
	COMMISSIONS	0	1	0	1			
		0.00	1.00	0.00				

OVERALL CLASSIFICATION ACCURACY 0.00 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY 0.00 P(BETA ERROR) = .33

PHASE II, DENVER LITTLETON
GRID 6
TEST TYPE: DIFFUSE COORDINATE

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CONFUSION TABLE

		MAPPED AS						MAPPING
	CLASS	R	A	O	TOTALS	OMISSIONS		ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	0	1	1	2	1	.50	.50
TOTALS		0	1	1	2	1		
COMMISSIONS		0	1	0	1			
		0.00	1.00	0.00				

OVERALL CLASSIFICATION ACCURACY .50 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY .25 P(BETA ERROR) = .17

PHASE II, DENVER LITTLETON
GRID 9
TEST TYPE: DIFFUSE COORDINATE

CONFUSION TABLE

		MAPPED AS						MAPPING
	CLASS	R	A	O	TOTALS	OMISSIONS		ACCURACIES
T								
R	RESIDENTIAL (R)	0	0	0	0	0	0.00	0.00
U	AGRICULTURE (A)	0	0	0	0	0	0.00	0.00
E	OTHER (O)	1	0	1	2	1	.50	.50
TOTALS		1	0	1	2	1		
COMMISSIONS		1	0	0	1			
		1.00	0.00	0.00				

OVERALL CLASSIFICATION ACCURACY .50 P(ALPHA ERROR)= .33

OVERALL MAPPING ACCURACY .25 P(BETA ERROR) = .17